

Cauda Equina Syndrome

Indexing Metadata/Description

- › **Title/condition:** Cauda Equina Syndrome
- › **Synonyms:** Compression of spinal nerve roots; spinal nerve roots, compression
- › **Anatomical location/body part affected**
 - The conus medullaris is the terminal end of the spinal cord, which ends between the L1 and L2 vertebrae of the spinal column. Descending from the conus medullaris are lumbar and sacral spinal nerves that are arranged in a fashion similar to a horse's tail. As a result, the network of nerves in this region is named cauda equina, Latin for horse's tail⁽⁵⁾
- › **Area(s) of specialty:** Oncology, Neurological Rehabilitation, Orthopedic Rehabilitation, Sports Rehabilitation
- › **Description**
 - Categorized as a form of low back pain (LBP), cauda equina syndrome (CES) is a condition in which the cauda equina nerve roots become compressed within the lumbar spinal canal⁽⁵⁾
 - Considered an uncommon condition, CES has a prevalence of 1 to 3 in 100,000 persons.⁽⁵⁾ However, CES is recognized by clinicians as a medical emergency that requires surgical decompression⁽³⁾
 - Symptoms resulting from the compression of the spinal nerves include loss of lower extremity motor function, loss of bowel and bladder control, and even paralysis. Lack of immediate treatment can result in sequelae and long-term dysfunction⁽⁶⁾
- › **ICD-10 codes**
 - G83.4 cauda equina syndrome; neurogenic bladder due to cauda equine syndrome

(ICD codes are provided for the reader's reference, not for billing purposes)

- › **Reimbursement:** No specific issues or information regarding reimbursement has been identified
- › **Presentation/signs and symptoms**
 - Initial symptoms of CES include lower extremity weakness, "saddle anesthesia" (impaired sensation of the buttocks and the perineal and perianal regions), and loss of bowel/bladder function⁽³⁾
 - Severe and worsening LBP,⁽³⁾ unilateral or bilateral sciatica/radicular symptoms,⁽³⁾ and sexual dysfunction can also be present.⁽⁴⁾ Patients can even report difficulty walking
 - Many clinicians sub-classify CES as⁽³⁾
 - CESS – CES suspected or suspicious
 - The diagnosis is not certain. Elective surgery is preferred over emergency surgery
 - CESI – Incomplete CES
 - If MRI is positive, surgery should be performed as soon as possible. Bladder and bowel function are typically normal post-surgery, though there may be a decrease in sexual function
 - CESR – CES with neurogenic retention of urine
 - Emergency surgery should be performed. Patients are often paralyzed and have a loss of bowel, bladder, and sexual function

Authors

Michael Granado, PT, MPT, ATC, CSCS
Cinahl Information Systems, Glendale, CA

Suzanne VanderKooi, PT, DPT
Cinahl Information Systems, Glendale, CA

Reviewers

Lisa Redavid, PT, DPT, OCS, COMT
Cinahl Information Systems, Glendale, CA

Rehabilitation Operations Council
Glendale Adventist Medical Center,
Glendale, CA

Editor

Sharon Richman, DHSc, MSPT, PT
Cinahl Information Systems, Glendale, CA

January 3, 2020

Causes, Pathogenesis, & Risk Factors

› Causes

- The most common cause of CES is a large lower lumbar disc herniation. Disc herniation is most often at the L4–L5 level.⁽³⁾ (See *Clinical Review...Herniated Disc*; Topic ID Number: T708470)
- Other etiologies
 - Tumor⁽³⁾
 - Spondylolisthesis
 - Spinal stenosis⁽³⁾
 - Infection⁽⁶⁾
 - Vertebral fracture/trauma⁽³⁾
 - Spinal manipulation⁽⁶⁾
 - Ankylosing spondylitis⁽⁶⁾
 - Trauma⁽³⁾

› Pathogenesis

- Compression of the spinal cord and nerves/nerve roots arising from L1–L5 can cause CES.⁽⁸⁾ Disc herniation is the most common cause of the compression of the cauda equina, usually at the L4–5 level⁽³⁾
- After compression of the cauda equina spinal nerves occurs, impairments in motor and sensory function of the lower extremities and “saddle” region begin. The nerves that supply the bowel and bladder are the pelvic splanchnic nerves, exiting the spinal column at S2–4.⁽¹³⁾ Compression to these nerves results in retention of urine/feces followed by incontinence⁽¹³⁾
- The nerve roots of the cauda equina are especially susceptible to compressive and tensile injury because of the absence of Schwann cells for protection and the lack of vascularity in the central portion of the nerve roots⁽⁹⁾

› Risk factors

- The majority of patients who experience CES have a history of LBP or disc herniations.⁽³⁾ Patients with spinal stenosis, spondylolisthesis, or other spinal pathologies might also be at risk

Overall Contraindications/Precautions

- › CES is a serious neurological disorder that is a surgical emergency. If CES is suspected, the patient should go to the emergency room (ER) immediately so that a thorough neurological examination, including MRI, can be conducted. If CES is diagnosed, immediate decompression surgery is required. All patients with suspected lumbar injuries or pathologies should be screened for CES; inquire about loss of bowel/bladder function or saddle paresthesias
- › See specific **Contraindications/precautions to examination** and **Contraindications/precautions** under **Assessment/Plan of Care**

Examination

› Contraindications/precautions to examination

- Although not all of the symptoms of CES might be present in patients, especially during the early stages, early detection is extremely important. Any discovery of the following red flags during the exam should prompt immediate referral of the patient to the ER and the patient should consult a neurosurgeon immediately:⁽¹⁰⁾
 - Severe LBP
 - Motor weakness in one or both legs
 - Altered bowel control
 - Altered bladder control
 - Widespread neurological deficit
 - Saddle anesthesia
 - Loss of reflexes in the extremities

> History

• History of present illness/injury

–Mechanism of injury or etiology of illness

- When did symptoms begin?
- Insidious onset vs. traumatic event?
- Damage to a vertebral disc, if the cause of CES, might be associated with repetitive, prolonged flexion of the spine as well as extended postures. (See *Clinical Review...Herniated Disc*, referenced above)

–Course of treatment

- Medical management

- Ask about patient's past and current medical management of symptoms. How has the condition responded to treatments?

- **Medications for current illness/injury:** Determine what medications clinician has prescribed; are they being taken? Are they effective? Opioids, NSAIDs, muscle relaxants, and analgesics may be prescribed for LBP

- Diagnostic tests completed

- X-ray might be used for indirect information⁽³⁾(e.g., to assess for the presence of tumors, fractures, infection, reduced disc space, or arthritic changes)
- MRI is used to assess for compression of the cauda equina and is the most reliable imaging tool for CES diagnosis.⁽³⁾Etiology of the compression is also evaluated. If MRI finds CES, immediate surgery is necessary
- When an MRI is contraindicated in a particular patient, then a CT myelogram can be used⁽³⁾

- **Home remedies/alternative therapy:** Document any use of home remedies (e.g., ice or heating pack) or alternative therapies (e.g., acupuncture) and whether they help

- **Previous therapy:** Document whether patient has had occupational or physical therapy for other conditions and what specific treatments were helpful or not helpful

–Aggravating/easing factors (and length of time each item is performed before the symptoms come on or are eased)

–Body chart: Use body chart to document location and nature of symptoms. Injury to the cauda equina can be asymmetrical or bilateral⁽³⁾

–Nature of symptoms: Document nature of symptoms (constant vs. intermittent, sharp, dull, aching, burning, numbness, tingling). See **Presentation/Signs and Symptoms** above

–Rating of symptoms: Use a visual analog scale (VAS) or 0–10 scale to assess symptoms at their best, at their worst, and at the moment (specifically address if pain is present now and how much). Back pain commonly is severe

–Pattern of symptoms: Document changes in symptoms throughout the day and night, if any (a.m., mid-day, p.m., night); also document changes in symptoms due to weather or other external variables

–Sleep disturbance: Document number of wakings/night, as well as level of comfort in various sleeping positions

–Other symptoms: Document other symptoms patient might be experiencing that could exacerbate the condition and/or symptoms that could be indicative of a need to refer to physician (e.g., night sweats, dizziness). Patients usually report saddle anesthesia and loss of bowel and/or bladder function as part of CES

–Barriers to learning

- Are there any barriers to learning? Yes ___ No ___

- If Yes, describe _____

• Medical history

–Past medical history

- **Previous history of same/similar diagnosis:** History of previous lumbar disc herniation, spondylolisthesis, spinal surgery, spinal tumor
- **Comorbid diagnoses:** Ask patient about other health concerns, including diabetes, cancer, heart disease, pregnancy complications, psychiatric disorders, orthopedic disorders, etc.
- **Medications previously prescribed:** Obtain a comprehensive list of medications prescribed and/or being taken (including OTC drugs)
- **Other symptoms:** Ask patient about other symptoms he/she might be experiencing

• Social/occupational history

–Patient's goals: Document what the patient hopes to accomplish with therapy and in general

–Vocation/avocation and associated repetitive behaviors, if any: Does the patient participate in recreational or competitive sports? What activities does the patient's occupation involve?

- **Functional limitations/assistance with ADLs/adaptive equipment:** Document reported functional limitations
- **Living environment:** Stairs, number of floors in home, with whom patient lives (e.g., family, caregivers). Identify if there are barriers to independence in the home, or if any modifications are necessary
- › **Relevant tests and measures: (While tests and measures are listed in alphabetical order, sequencing should be appropriate to patient medical condition, functional status, and setting.)**
 - **Assistive and adaptive devices:** Assess for need, appropriate fit, and appropriate use. Might require cane or walker if in severe pain, especially if symptoms of lower extremity radicular pain or motor loss are present
 - **Balance:** Assess balance statically and dynamically. Decreased balance, difficulty turning, increased base of support, and other deficits are typically not observed
 - **Gait/locomotion:** Assess for gait impairment secondary to motor and sensory losses per patient's tolerance
 - **Muscle strength:** To check the lower extremity myotomes:⁽¹¹⁾
 - Hip flexion (L1–L2)
 - Knee extension (L3–4)
 - Ankle dorsiflexion (L4–5)
 - First toe extension (L5)
 - Ankle eversion (S1)
 - Knee flexion (S2)
 - Ankle plantarflexion (S1–2)
 - **Posture:** Assess general posture; assess for loss of lumbar lordosis and guarded posture in standing/sitting. Also assess for the following:
 - Abnormal lordosis
 - Inappropriate pelvic tilt
 - Decreased lumbar lordosis
 - Lateral shifting
 - Forward head posture
 - Internally rotated shoulders
 - Kyphosis
 - Scoliosis
 - Height symmetry of joints and anatomical landmarks
 - **Reflex integrity:** Lower extremity reflexes at or below the level of compression will be diminished. Check the lower extremity reflexes:⁽⁵⁾
 - Patellar (L3–4)
 - Achilles (S1)
 - **Sensory testing:** Assess for loss of sensation throughout the lumbar and sacral dermatomes to pinprick and light touch. Bilateral deficits might be noted.⁽⁸⁾ Also inquire about the presence of paresthesias. Check the lower extremity dermatomes:⁽¹¹⁾
 - Inguinal area (L1)
 - Proximal anterior thigh (L2)
 - Distal anterior thigh (L3)
 - Medial lower leg (L4)
 - Lateral lower leg (L5)
 - Posterior calf (S1)

Assessment/Plan of Care

- › **Contraindications/precautions**
 - Patients presenting with possible CES should go to the ER immediately for further evaluation and possible emergency surgical intervention⁽³⁾
 - Patients with this diagnosis are at risk for falls; follow facility protocols for fall prevention and post fall-prevention instructions at bedside, if inpatient. Inform patient and family/caregivers of the potential for falls and educate about fall-prevention strategies. Discharge criteria should include independence with fall-prevention strategies. Rehabilitation professionals should always use their professional judgment

- › **Diagnosis/need for treatment:** The best outcome for patients with CES involves surgical decompression⁽¹⁾ (e.g., microdiscectomy, wide laminectomy, wide laminectomy with discectomy). Once stabilized, physical therapy may be a part of the patient's recovery program
- › **Rule out**
 - Mechanical LBP
 - Conus medullaris syndrome
 - Lumbar vertebral fracture
 - Osteoarthritis
 - Neurological conditions (e.g., multiple sclerosis, amyotrophic lateral sclerosis)
- › **Prognosis**
 - Based on a retrospective cohort study in the United States, early surgical decompression (within 24 hours of symptom onset) significantly improves patient outcomes⁽⁷⁾
 - Delayed treatment (≥ 48 hours) showed increased likelihood of inpatient mortality, unfavorable discharge, prolonged postsurgical length of stay, and high hospital charges
 - In a retrospective study in Ireland of 136 patients treated for CES, researchers concluded that surgical decompression significantly improves patient symptoms⁽¹⁾
 - Timing of surgery and resolution of symptoms were evaluated in three groups: early surgical decompression (performed < 24 hours from onset), 24–48 hours post onset, and > 48 hours post onset
 - There was improvement in CES symptoms postoperatively in all groups
 - Back pain and saddle paresthesia were the most likely symptoms to resolve post surgery
 - For the majority of patients, bowel and bladder function improved postoperatively; however, even with early surgery (< 24 hours from onset) not all patients had full resolution of bowel and bladder symptoms
 - The authors recommend performing surgery as soon as pragmatically possible with respect to protecting patient safety
 - Based on a study in the Netherlands which evaluated postoperative outcomes for patients with CES due to lumbar herniated disc, dysfunction of micturition, defecation, and sexual function were highly prevalent several years postoperatively⁽¹²⁾
 - Thirty-seven patients were included in the study
 - The average time at follow up was 13.8 years postoperative
 - At follow-up, 38% of patients reported micturition dysfunction, 43% reported defecation dysfunction, and 54% reported sexual dysfunction
 - There is general agreement among researchers and clinicians that early intervention is essential in recovery of neurological function and prevention of further neurological losses. Risk of sequelae is great with delayed diagnosis and treatment⁽⁶⁾
- › **Referral to other disciplines**
 - ER
 - Neurosurgeon⁽⁴⁾
 - Orthopedic spine surgeon
- › **Other considerations**
 - There is a need to improve resources and access to psychosocial support for patients post CES⁽²⁾
- › **Treatment summary:** N/A

Problem	Goal	Intervention	Expected Progression	Home Program
---------	------	--------------	----------------------	--------------

Impaired gait; paraplegia; sensory impairments; loss of bowel/bladder function; impaired sexual function	Identify CES Send patient to ER immediately	Referral to other disciplines Physical therapy is not appropriate in CES. Immediate transport to the ER is warranted. Upon confirmation of CES by neurological examination and MRI, the patient will likely undergo immediate decompression surgery by a neurosurgeon or orthopedic spinal surgeon	N/A	N/A
--	--	--	-----	-----

Desired Outcomes/Outcome Measures

- › Proper identification of CES and patient sent to ER when first suspected/identified
 - Following surgical decompression, the outcome is based on measurements of motor function, sensory function, bowel and bladder function, and sexual function

Maintenance or Prevention

- › Early diagnosis and treatment of CES are essential to prevent more advanced and irreversible neurological damage

Patient Education

- › See “Cauda Equina Syndrome” from the American Academy of Orthopaedic Surgeons at <https://orthoinfo.aaos.org/en/diseases--conditions/cauda-equina-syndrome>
- › See “Cauda Equina and Conus Medullaris Syndromes” from Medscape at <https://emedicine.medscape.com/article/1148690-overview#showall>
- › See “Cauda Equina Syndrome” from the American Association of Neurological Surgeons at <https://www.aans.org/Patients/Neurosurgical-Conditions-and-Treatments/Cauda-Equina-Syndrome>

Coding Matrix

References are rated using the following codes, listed in order of strength:

M Published meta-analysis	RV Published review of the literature	PP Policies, procedures, protocols
SR Published systematic or integrative literature review	RU Published research utilization report	X Practice exemplars, stories, opinions
RCT Published research (randomized controlled trial)	QI Published quality improvement report	GI General or background information/texts/reports
R Published research (not randomized controlled trial)	L Legislation	U Unpublished research, reviews, poster presentations or other such materials
C Case histories, case studies	PGR Published government report	CP Conference proceedings, abstracts, presentation
G Published guidelines	PFR Published funded report	

References

1. Heyes G, Jones M, Verzin E, McLorinan G, Darwish N, Eames N. Influence of timing of surgery on cauda equina syndrome: outcomes at a national spinal centre. *J Orthop.* 2017;15(1):210-215. doi:10.1016/j.jor.2018.01.020. **(G)**
2. Hall R, Jones K. The lived experience of cauda equina syndrome: a qualitative analysis. *Spinal Cord.* 2018;56(1):41-45. doi:10.1038/sc.2017.92. **(R)**
3. Hur JW, Park DH, Lee JB, Cho TH, Park JY. Guidelines for cauda equina syndrome management. *JNIC.* 2019;2(1):14-16. doi:10.32587/jnic.2019.00136. **(G)**
4. Korse NS, Pijpers JA, van Zwet E, Elzevier HW. Cauda equina syndrome: presentation, outcome, and predictors with a focus on micturition, defecation, and sexual dysfunction. *Eur Spine J.* 2017;26(3):894-904. doi:10.1007/s00586-017-4943-8. **(R)**
5. Berg EJ, Ashurst JV. Anatomy, back, cauda equina. National Center for Biotechnology Information Web site. <https://www.ncbi.nlm.nih.gov/books/NBK513251/>. Published December 6, 2018. Accessed August 20, 2019. **(GI)**
6. Dias ALN, Araújo FF, Cristante AF, Marcon RM, Barros Filho TEP, Letaif OB. Epidemiology of cauda equina syndrome. What changed until 2015? *Rev Bras Ortop.* 2018;53(1):107-112. doi:10.1016/j.rboe.2017.11.006. **(R)**

7. Thakur JD, Storey C, Kalakoti P, et al. Early intervention in cauda equina syndrome associated with better outcomes: a myth or reality? Insights from the Nationwide Inpatient Sample database (2005-2011). *Spine J.* 2017;17(10):1435-1448. doi:10.1016/j.spinee.2017.04.023. **(R)**
8. Rider IS, Marra EM. Cauda equina and conus medullaris syndromes. National Center for Biotechnology (NCBI) Web site. <https://www.ncbi.nlm.nih.gov/books/NBK537200/?report=printable>. Published January 22, 2019. Accessed August 20, 2019. **(GI)**
9. Douraiswami B, Muthuswamy K, Naidu DK, Thanigai S, Anand V. Indeterminate cauda equina syndrome: a case report. *J Clin Orthop Trauma.* 2016;7(1):50-54. doi:10.1016/j.jcot.2015.06.002. **(C)**
10. Cauda equina syndrome. American Association of Neurological Surgeons Web site. <https://www.aans.org/en/Patients/Neurosurgical-Conditions-and-Treatments/Cauda-Equina-Syndrome>. Published 2019. Accessed August 22, 2019. **(GI)**
11. ASIA impairment scale. American Spinal Injury Association Web site. https://asia-spinalinjury.org/wp-content/uploads/2016/02/International_Stdg_Diagram_Worksheet.pdf. Accessed August 22, 2019. **(GI)**
12. Korse NS, Veldman AB, Peul WC, Vleggeert-Lankamp CLA. The long term outcome of micturition, defecation and sexual function after spinal surgery for cauda equina syndrome. *PLoS One.* 2017;12(4):e0175987. doi:10.1371/journal.pone.0175987. **(R)**
13. Dawodu ST. What is the anatomy of the cauda equina (CE) and conus medullaris? Medscape Web site. <https://www.medscape.com/answers/1148690-81991/what-is-the-anatomy-of-the-cauda-equina-ce-and-conus-medullaris>. Published July 14, 2018. Accessed August 23, 2019. **(GI)**