



# Cauda Equina Syndrome Presenting as Unilateral Calf Myalgia

Courtney Hart PA-S, Zachary Lavender PA-C

Quinnipiac University Physician Assistant Program



## Introduction

- Cauda equina syndrome (CES) is a clinical syndrome with a wide range of signs and symptoms including lower back pain, sciatica,<sup>1</sup> saddle area anesthesia or hypoesthesia, bladder or bowel dysfunction, sexual dysfunction, and bilateral lower extremity (LE) sensory and motor deficits.<sup>2</sup> However, it can also present atypically as in this case.
- Cauda equina refers to the spinal nerve roots that travel together below the level of the spinal cord, including L2-L5, S1-S5, and the coccygeal nerve.<sup>3</sup> In patients presenting to an emergency department (ED) with low back pain, 0.1% to 1.9% had spinal cord or cauda equina compression.<sup>4</sup>
- Risk factors include lumbar spinal surgery,<sup>5</sup> administration of spinal anesthesia,<sup>6</sup> and increased BMI.<sup>7</sup>
- The most common etiology is lumbar intervertebral disc herniation at the L4/L5 or L5/S1 level.<sup>8</sup> Other causes include tumor, trauma,<sup>8</sup> epidural abscess,<sup>9</sup> epidural hematoma,<sup>10</sup> and arachnoiditis.<sup>6</sup>
- CES is one of the only nontraumatic spinal pathologies that is a true neurosurgical emergency.<sup>11</sup>
- Figure 1 depicts the three clinical stages of CES progression.<sup>12</sup>
- Diagnosis is made via history, physical exam (PE), and radiological findings in combination with high clinical suspicion.<sup>5</sup>
- The gold standard to diagnose cauda equina syndrome is MRI of lumbar spine.<sup>13</sup> An example of CT and MRI imaging in a patient with CES is seen in Figure 2.<sup>14</sup>
- The key points of the PE for someone with suspected CES are the neurologic and rectal exam.<sup>13,15</sup> (Fairbank, Mehta) Perianal sensory loss and reduced anal tone have a high specificity in predicting MRI proven CES.<sup>13</sup> (Fairbank)- change #s from here down
- Treatment is surgical decompression within 48 hours.<sup>16</sup>
- Prognosis is most strongly predicted by pre-decompression function.<sup>17</sup>

## Case Description

- 22 year-old Hispanic male
- Past Medical History: Obesity
- Past Surgical History: None reported
- Medications: None reported.
- Allergies: No known drug allergies.
- Family History: None
- Social History: Non-smoker, no alcohol use, no illicit drug use
- Review of Symptoms: Unremarkable except as mentioned in HPI each visit.
- Figure 3 depicts the patient's three visits to the ED that led to a diagnosis of CES.

**Table 1. Emergency Department Course Showing Progression of CES**

	ED Visit 1	ED Visit 2	ED Visit 3
Chief Complaint	Left calf pain	Bilateral calf cramping	Pain, weakness, and numbness in bilateral LE
<b>Brief History</b>	One day history of atraumatic left calf pain radiating to inner thigh.	Patient returned two days after initial visit complaining of severe bilateral lower extremity cramping. Cramping described as intermittent and lasting 20-30 minutes before resolving.	One day after ED visit 2, the patient presented with progressive weakness and numbness, and continued pain in his bilateral lower extremities. Unable to walk or stand. Patient c/o associated back pain, numbness in groin and perianal area, and one episode of urinary incontinence.
Pertinent Negatives	<ul style="list-style-type: none"> <li>Denied recent trauma.</li> <li>He reported no back pain.</li> <li>Denied radicular pain or sensory changes.</li> <li>Denied lower extremity weakness.</li> </ul>	<ul style="list-style-type: none"> <li>Denies back pain.</li> <li>Denies fever or chills, chest pain, or SOB</li> </ul>	<ul style="list-style-type: none"> <li>Denied dysuria, fever, chest pain, hematuria.</li> </ul>
<b>Physical Exam</b>	Vitals: T 97.9 F, Pulse 66 bpm, RR 12 breaths/min, BP 123/84 mmHg, O2 99% Weight: 265 lb • Neuro exam: AAOx3. Normal cognition, speech, and gait. No sensory deficits noted. • MSK exam of LE: Full ROM, normal muscle tone, and 5/5 strength of bilateral LE. No calf erythema, edema, warmth, or tenderness. Dorsalis pedis and posterior tibial pulses 2+ bilaterally.	Vitals: T 97.7 F, Pulse 84 bpm, RR 16 breaths/min, BP 129/85 mmHg, O2 99% • Neuro exam: AAOx3. Motor, sensory, gait intact. • MSK: No edema, erythema, calf tenderness. Negative Homan's sign bilaterally.	Vitals: T 97.9F, Pulse 73 bpm, RR 16 breaths/min, BP 132/85, O2 99% • Back: Lumbar spinal and paraspinal muscle tenderness. Positive SLR bilaterally. • Neuro: AAOx3. Decreased sensation BL LE. • MSK: Full ROM of bilateral LE and 5/5 strength while lying supine in stretcher. Unable to bear weight or walk. DP pulses intact. No visible swelling of LE. • Rectal exam: Normal sphincter tone. Perianal numbness. Unaware of internal rectal exam.
<b>Diagnostic Tests and Results</b>	• None performed.	<ul style="list-style-type: none"> <li>CBC and chemistry panel to evaluate electrolytes, anemia within normal limits.</li> <li>Potassium: 4.0 mmol/L</li> <li>Sodium: 139 mmol/L</li> <li>D-Dimer High Sensitivity to rule out DVT: &lt;200</li> </ul>	<ul style="list-style-type: none"> <li>Bladder ultrasound revealed large amount of retained urine.</li> <li>Urinalysis WNL.</li> </ul> CT lumbar spine ordered due to unavailability of MRI at hospital. CT results are seen below.
Diagnosis at Current Visit and Treatment	Muscle spasm → discharged home with naproxen and cyclobenzaprine as needed Instructed to return with any worsening symptoms.	Myalgia → Ketorolac shot administered and discharged home with instructions to return if symptoms worsen.	Cauda equina syndrome

Differential Diagnosis included: DVT, myalgia, cauda equina syndrome, herniated disc, lumbar radiculopathy, epidural abscess, malignancy

## Case Description: CT Impression

- At L4-L5, there is a large central disc osteophyte protrusion that along with additional multifactorial degenerative changes and congenitally short pedicles results in suspected severe central canal stenosis with compression of the cauda equina nerve roots. Lumbar spine MRI as clinically indicated. Neurosurgical consultation recommended.
- At L5-S1, multifactorial degenerative changes result in severe left subarticular zone stenosis with suspected compression of a congenitally conjoined left L5-S1 nerve root within the left subarticular zone and severely stenotic proximal left neural foramen.
- The bladder is significantly distended and the renal collecting systems and ureters are moderately distended bilaterally.

## Patient Management and Outcome

### Case Patient Management

- All interventions attempted at the ED:
  - For suspected myalgia: naproxen 500 mg PO BID PRN, cyclobenzaprine 10 mg PO Q8H PRN, ketorolac 60 mg IM once
  - Foley placed for urinary retention. Output 1200 ml.
- Once CT imaging revealed evidence of CES, patient was urgently transferred to university hospital and neuro-spine department for further evaluation and treatment.

### Generalized CES Outcomes

- Surgical decompression within 48 hours from onset of CES significantly improves chances of full resolution of sensory and motor deficits and preserved urinary and rectal function.<sup>16</sup>
- There is a greater chance of persistent bladder dysfunction, motor deficit, pain, and sexual dysfunction with delayed surgery.<sup>18</sup>
- Morbidity and mortality is high in CES. Recovery after decompression is slow and often incomplete regarding micturition, defecation, and sexual function.<sup>2</sup>

## Discussion

- Current guidelines identify the severe, often irreversible, late CES signs and symptoms as red flags. The guidelines should instead highlight the early deficits, listed in Figure 3, as warning signs to help ED clinicians include CES in a differential diagnosis before progression to CES-R.<sup>19</sup>
- A 6-year retrospective study revealed that 79% of patients who were admitted for CES had a delay from ED presentation to neurosurgical consult that was more than 48 hours. This highlights the need for clinicians to be more aware of its various presentations to avoid delay in diagnosis.<sup>8</sup>
- Although bilateral LE neurologic changes are more characteristic of CES, one study found that 15% of patients diagnosed with CES had complained of unilateral lower extremity pain.<sup>12</sup>
- Progressive sensory-motor deficits in unilateral or bilateral lower extremity signifies the onset of CES, and recent research urges clinicians to order lumbar imaging at this point without waiting for sphincter dysfunction.<sup>12</sup>
- In this case, imaging was delayed until urinary retention was recognized and a rectal exam revealed perianal anesthesia. Although the outcome of this patient after transfer is unknown, the presence of urinary retention and saddle anesthesia are risk factors for a poor prognosis.<sup>19</sup>
- Because history and physical exam findings alone are not specific, lumbar imaging must be done. Ideally, community hospitals should have access to MRI 24/7, so imaging can confirm CES before transfer to a higher level facility.<sup>13</sup>
- CT lumbar imaging is 86% specific in predicting significant spinal stenosis if thecal sac effacement is >50%. CT can also be used as an effective and resourceful screening tool to rule out CES when clinical suspicion is low.<sup>14</sup>

**Figure 3. Presentation of Early CES for ED Clinicians to Recognize<sup>19</sup>**

Early signs/symptoms of CES	Late signs/symptoms of CES
<ul style="list-style-type: none"> <li>Progressive neurological deficits in the lower extremities</li> <li>Impaired bladder or urethral sensation, hesitancy, poor stream with retained control of micturition</li> </ul>	<ul style="list-style-type: none"> <li>Impaired perineal sensation</li> <li>Impaired anal tone</li> <li>Urinary retention or incontinence</li> <li>Fecal incontinence</li> <li>Perianal anesthesia</li> </ul>

Data from: Todd NV. Guidelines for cauda equina syndrome. Red flags and white flags. Systematic review and implications for triage. *Br J Neurosurg*. 2017;31(3):336-339. doi:10.1080/02688697.2017.1297364.

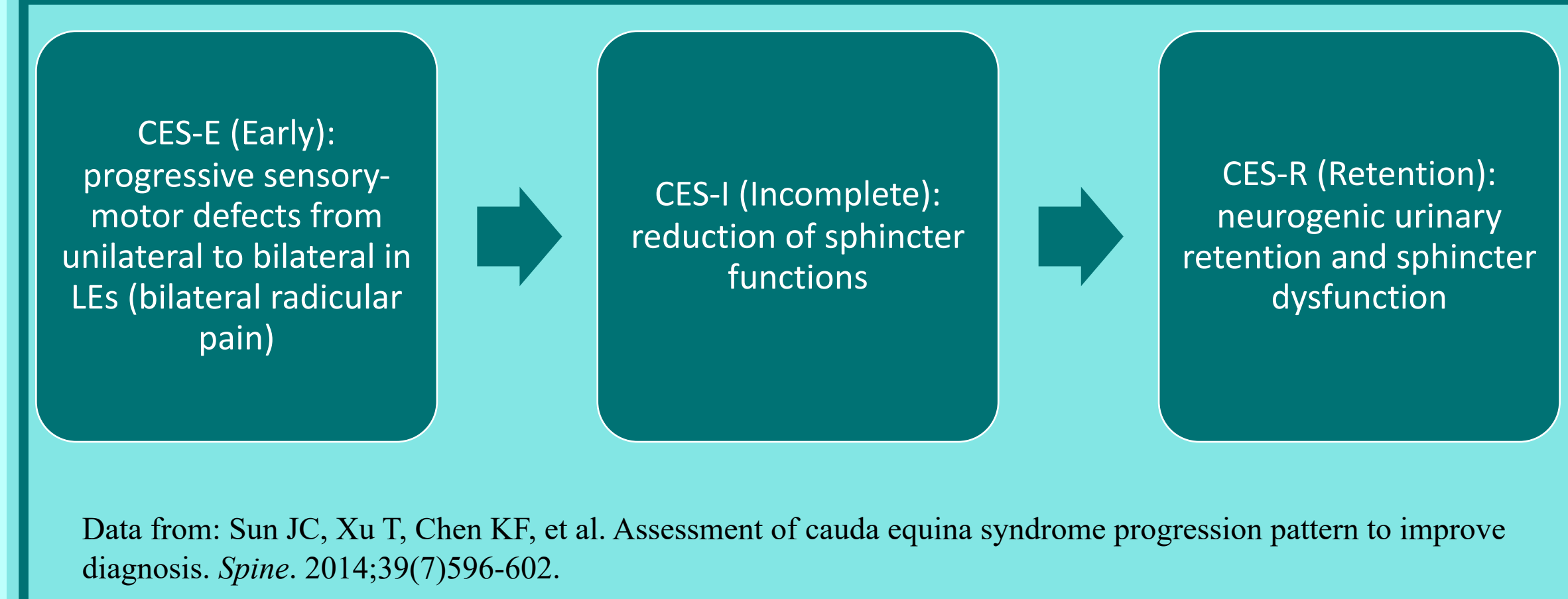
## Conclusion

- Cauda equina syndrome is a collection of symptoms that include sciatica, saddle anesthesia, urinary retention, and sphincter dysfunction. Diagnosis is achieved through PE and lumbar imaging.
- The true red flags of CES are the early deficits it can present with. These red flags should prompt emergency lumbar imaging and neurosurgical consult.
- Familiarity with uncharacteristic clinical presentations of CES, including unilateral lower extremity numbness and weakness without sphincter involvement or saddle anesthesia, will help clinicians to recognize premonitory features of CES.
- For community hospitals without access to MRI, CT scan should be obtained before transferring the patient.

## References

- Kostak J, Harrington J, Alexander D, Rand W, Evans D. Cauda equina syndrome and lumbar disc herniation. *J Bone Joint Surg Am*. 1986;68(3):386-391.
- Korse NS, Poppers JA, van Zwet E, Elsevier HW, Vliegeland-Lankamp CL. Cauda Equina Syndrome: presentation, outcome, and predictors with focus on micturition, defecation, and sexual dysfunction. *Eur Spine J*. 2017;26(3):394-404. doi:10.1007/s00586-017-4943-3.
- Alf, Brady V, Dabhoi AB, Anatomy, Back, Anterior Spinal Artery, In: StatPearls. Treasure Island (FL): StatPearls Publishing; July 31, 2020.
- Galliker G, Scherer DE, Trappell MA, Rasmussen-Hart E, LeMaire R, Werth MM. Low back pain in the emergency department: prevalence of serious spinal pathologies and diagnostic accuracy of red flags. *Am J Med*. 2020;131(10):1607-1614. doi:10.1016/j.amjmed.2019.06.005.
- Podar S. Cauda equina lesions as a complication of spinal surgery. *Eur Spine J*. 2010;19(3):451-457. doi:10.1007/s00586-009-1170-y.
- Mirno-Ureña W, Villagra-Schmidt M, Ulloa-Vazquez P, et al. Cauda equina syndrome following an unsuccessful spinal anesthesia in a patient undergoing drainage of the Bartholin abscess: A case report. *Medicine (Baltimore)*. 2018;97(19):e10913. doi:10.1093/med/97.19.e10913.
- Venkatesan M, Litigues C, Perantoniou G, Braybrooke JR, Newey ML. Is cauda equina syndrome linked with obesity? *J Bone Joint Surg Br*. 2012;94(11):1551-1556. doi:10.1302/0301-220X.94B11.29652.
- Fairbank JC, Dolan P, Leung A, Lurie JB, Crookall M, Hancock T. Epidemiological study of cauda equina syndrome. *Acta Orthop*. 2013;82(1):159-162. doi:10.1080/00037019.2013.785201.390030000.
- Linshan B, Sullivan P, Street J, Doherty S. Epidural abscess causing cauda equina syndrome. *Ir J Med Sci*. 2005;174(3):88-91. doi:10.1007/BF03169156.
- Halkar NA, Veeraraj V, Veeraraj M, Veeraraj R. Progression after spinal cord and cauda compression in a spontaneous spinal epidural hematoma. *Neurology*. 2015;84(18):1984-1985. doi:10.1212/WNL.0000000000001545.
- The University of Cincinnati. Residents. *Spinal Trauma and Emergencies*. In: Sutton JM, Beckwith MA, Johnson BL, Walker A, Watson CL, Wilson GC, eds. *The Most Read Surgical Handbook*. 7th ed. Elsevier; 2018:801-802.
- Sun JC, Xu T, Chen KF, et al. Assessment of cauda equina syndrome progression pattern to improve diagnosis. *Spine*. 2014;39(7):596-602.
- Fairbank J, Haslam R, Dickey A, Patel AA, Dettmer JR. Does patient history and physical examination predict MRI proven cauda equina syndrome? *Evid Based Spine Care J*. 2011;24(2):73-33. doi:10.1055/s-0031-1274754.
- Paucok JG, Timpono VM. Doing more with less: diagnostic accuracy of CT in suspected cauda equina syndrome. *LNR - Am J Neurosurg*. 2017;38(2):391-397. doi:10.3174/ajnr.A4974.
- Melina N, Garber D, Kaye J, Ramakrishnan M. Documentation of Focal Neurology on Patients with Suspected Cauda Equina Syndrome and the Development of an Assessment Protocol. *Open Orthop J*. 2015;9:390-394. Published 2015 Aug 31. doi:10.2174/174475281509010390.
- Alin LM, Alin NI, Bichokowski JM, et al. Cauda equina syndrome secondary to lumbar disc herniation. *Spine*. 2000;25(12):1515-1522.
- Pruss S, Kralj C, Bialkovic E, Medved MR, Suljan P. Compressive pressure versus time in cauda equina syndrome. *Spine*. 2019;44(17):1238-1247.
- Shapiro S. Medical realities of cauda equina syndrome secondary to lumbar disc herniation. *Spine*. 2000;25(3):348-352. doi:10.1097/00007632-200002010-00015.
- Todd NV. Guidelines for cauda equina syndrome. Red flags and white flags. Systematic review and implications for triage. *Br J Neurosurg*. 2017;31(3):336-339. doi:10.1080/02688697.2017.1297364.

**Figure 1: Cauda Equina Syndrome Progression<sup>12</sup>**



**Figure 2. CT and MRI Findings<sup>14</sup>**



Images obtained from: Peacock JG, Timpono VM. Doing more with less: diagnostic accuracy of CT in suspected cauda equina syndrome. *AJNR Am J Neuroradiol*. 2017;38(2):391-397. doi:10.3174/ajnr.A4974