Five Things to Know about Cauda Equina Syndrome

ABSTRACT

Cauda Equina Syndrome (CES) is a rare progressive syndrome of pain and neurological deficits below the waist caused by massive central lumbar disc prolapse. The most common clinical presentation is highly variable with multifocal mixed polyradicular deficits. Loss of bladder and/or bowel control can be subtle and is frequently not the patient' chief complaint. These symptoms must be aggressively sought by the assessing physician. While delays of a few hours in the diagnosis and management may not be deleterious, definitive lumbar MRI imaging and (if positive) surgical care referral are emergent.

KEYWORDS: Cauda Equina Syndrome; Presentation; Diagnosis; Outcome

CME Pre-test Quiz

1. Anatomy—What is the Cauda Equina, and why isn't this a Spinal Cord Problem?

The spinal cord begins at the base of the brain and travels through the spinal canal of the seven cervical and 12 thoracic vertebrae. It ends in the upper lumbar area at about the L1/L2 disc space. The end of the cord, the conus medullaris is slightly thickened and contains the cell bodies of nerve roots that extend down the central spinal canal past the lumbar and sacral levels. These nerve roots are numbered from L1 to L5 and S1 to S4. There may be a couple of coccygeal branches.

Sitting inside the dural sac, these nerve roots resemble fine spaghetti (spaghettini, really) or a pony's tail, hence the Latinised name Cauda Equina or "horse's tail".[1]

Neurological tissue generally has a very poor blood supply.[2] The cauda equina nerve roots may have no visible surface vessels at all. The spinal cord is exquisitely sensitive to compression or impact trauma. By contrast the roots of the cauda equina float in a spinal fluid bath contained by the dural sac. This structure allows them a

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greater degree of movement and better resistance to direct trauma.

Acute nerve root compression by a herniating disc or other pathologies is the most frequent cause of constant radicular leg-dominant pain. The symptoms of this "sciatica" vary considerably and depending upon the particular root(s) involved include pain, loss of motor strength, numbness or tingling, or variable combinations of these. Most commonly, a single nerve root is involved at a time.

The pathology of Cauda Equina Syndrome (CES) is classically described as a sudden, complete loss of all neurological function caused by an acute, massive central disc herniation. Fortunately this is exceedingly rare, representing less than 1% of surgical lumbar disc hernias.[3,4,5] In addition to suffering extreme back and leg pain, the patient loses sensation and movement below the waist and experiences impaired bladder and bowel control. .

2. Cauda Equina Compression vs. Cauda Equina Syndrome

Lumbar spinal stenosis is a common problem of the aging spine and can compress the cauda equina. As discs dehydrate with age they collapse slowly and we grow shorter. Shortening the "anterior column" of the spine causes a load transfer to the bony facet joints which in turns cause them to thicken and with the compressed ligamentum flavum encroach on the canal. Symptoms of cauda equina compression include back and/or leg pain, weakness, numbness and tingling, classically brought on with erect posture and ambulation and relieved by rest in flexion.[6] This is not Cauda Equina Syndrome.

Our radiology colleagues can cause great confusion here when they refer to disc hernias or other pathologies causing "stenosis" in the lumbar canal. Technically they're correct but because degenerative lumbar spinal stenosis is a clinical entity, it would preferable to describe as narrowing the spinal canal or compressing the neurological elements.

Spinal stenosis symptoms typically have an insidious onset and can remain stable over long periods of time. Neural tissue can accommodate to the gradual application of stress Slow progression is key. The sacral nerve roots that control bladder (S2) and bowel (S4) are small and their central location in the canal provides anatomic resistance to compression. Because of this, they are virtually never affected in incremental spinal canal narrowing. Significant symptoms of perineal and perirectal numbness or tingling are never seen in spinal stenosis. Urinary retention and fecal incontinence are essentially unheard of in stable spinal stenosis where the volume capacity of the lumbar canal varies

with posture.[7]

Cauda Equina Syndrome is different. It is an acute compression of the neural elements almost always caused by central, massive prolapse of a lumbar disc. There is no time for mechanical accommodation by the nerve roots. Neural dysfunction is worsened by the inflammation associated with the extruded nuclear disc material.[8] These nuclear extrusions fill the entire cross section of the lumbar spinal canal, impacting even those relatively protected sacral roots causing loss of bowel and/or bladder control.

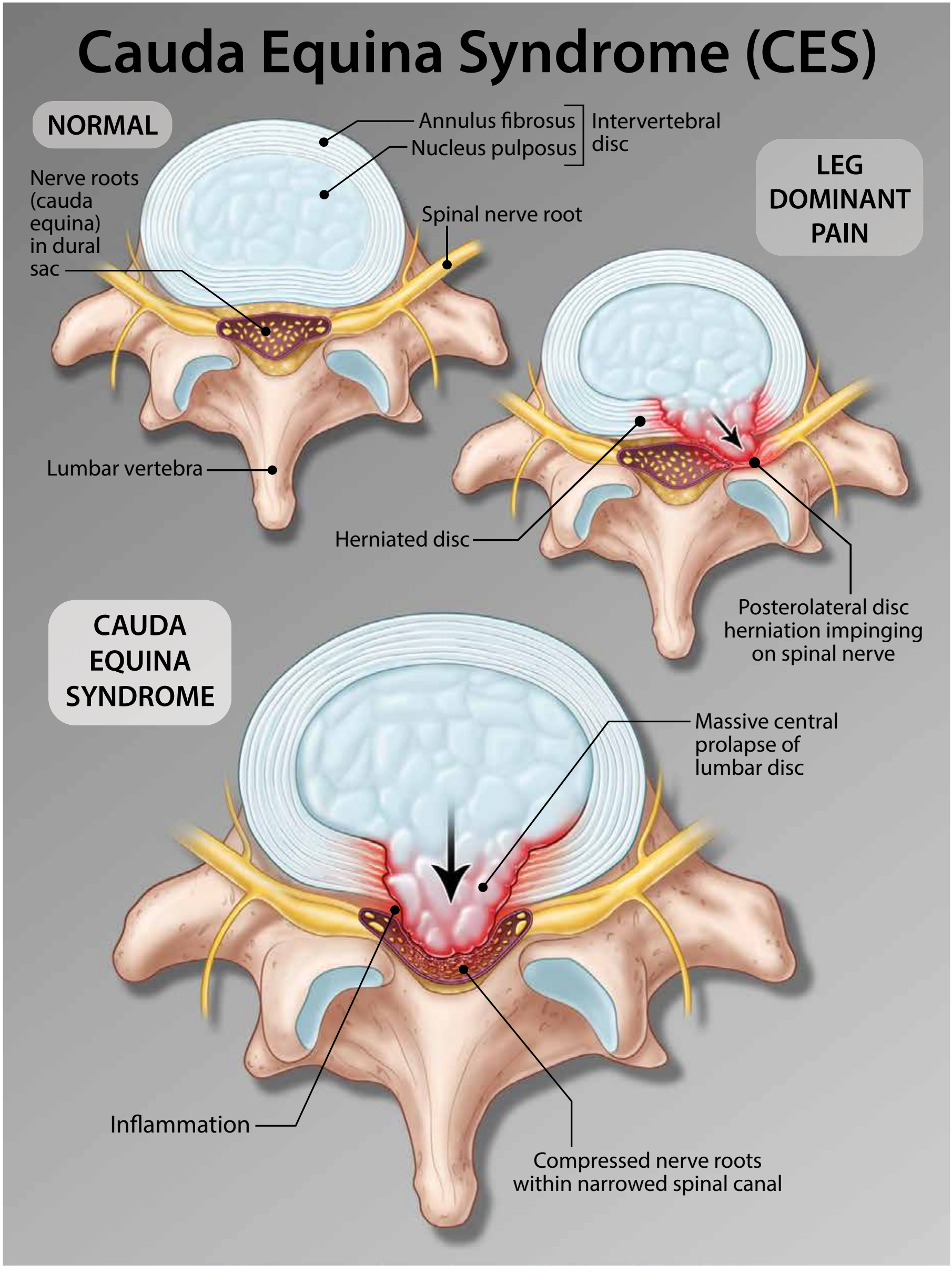
3. What are the Red Flags—how does Cauda Equina Syndrome differ from routine sciatica?

Although CES is has been described in undergraduate medical education as a sudden, complete loss of all neurological function below the waist, that presentation is exceedingly rare. The clinical presentation is usually one of incomplete or mixed polyradicular deficits that may affect one or both legs with or without saddle symptoms. The bowel and bladder changes may both be present or the urinary retention may appear in isolation. Conversely, the dominant symptom may be perineal numbness without significant leg pain. The most common presenting symptom is leg dominant pain and initially almost half of these patients have no sphincteric disturbances at all.[9,10] The CES patient differs from common sciatica in their rapid progression of symptoms, often over several days. These patients return repeatedly as their uncontrollable pain escalates. In medical malpractice cases involving paralysis[11,12] it's common for these patients to have seen several doctors over several days and to have been dismissed as drug seekers or malingerers. The diagnosis can be missed.

The pain of sciatica, while severe, is usually less intense. Patients remain mobile and although their routines are significantly disrupted, they can often work and remain largely functional. Classically, the symptoms and signs of sciatica are limited to the distribution of a single nerve root. They may have some urinary urgency and minor dribbling incontinence but they do not lose control.

In contrast, the CES patient typically has unremitting, overwhelming pain that usually extends down one leg but may affect both legs. They often have a locomotor impairment. If they can walk, they hobble and exhibit a "sciatic scoliosis" as they involuntarily attempt to accommodate their neurological compressions. In the Emergency Department they may refuse to stand or walk and may prefer to sit without moving.

Loss of bowel and bladder con-


Cauda Equina Syndrome (CES)
NORMAL
Annulus fibrosus
Nucleus pulposus
Intervertebral disc
Nerve roots (cauda equina) in dural sac
Spinal nerve root
Lumbar vertebra
LEG DOMINANT PAIN
Herniated disc
Posterolateral disc herniation impinging on spinal nerve
CAUDA EQUINA SYNDROME
Massive central prolapse of lumbar disc
Inflammation
Compressed nerve roots within narrowed spinal canal

trol can mean many things. It is critical to enquire directly. Patients overwhelmed by back or leg pain rarely notice these symptoms and don't volunteer the history. Initially there will be urinary retention as motor output to the bladder detrusor is compromised. As the bladder fills and the weight of urine overcomes the strength of the closed, denervated sphincter, there will be overflow incontinence, usually small but frequent voids.

Every patient with the acute onset of low back or leg pain must be asked, "Since the start of your pain, has there been any change in your bowel or bladder function?" If after consideration, the patient reports no alteration in these functions, the possibility of an acute Cauda Equina Syndrome is substantially reduced. If, however, there is any suspicion of impaired function, the patient must have either a bladder scan or post-void bladder catheterization to assess retention. A digital rectal examination is mandatory but can be misleading.

4. Is this a Time-Sensitive Surgical Emergency?

The overwhelming body of basic science research indicates that the longer a nerve root is compressed, the worse the prognosis for recovery.

A prospective randomized control trial on the timing of treatment for acute CES is not possible. Because it is so rare, even epidemiological studies are extremely challenging and difficult to design and execute. The literature on treating acute Cauda Equina Syndrome is one of anecdotal reports and short case series. A meta-analysis done by Ahn *et al.* in 2000[13] analyzing 322 patients suggested a critical watershed for improved prognosis with surgical decompression done within 48 hours of the onset of symptoms. Earlier surgery had a nine times greater change of

SUMMARY OF KEY POINTS

1. The CES patient often presents with rapidly escalating, poorly controlled pain. There may be daily or even more frequent physician visits.
2. While standing, the CES patient commonly adopts a "sciatic scoliosis": forward bending at the waist and leaning to either side as they attempt to decompress themselves. They may limp or need walking aids. These features help distinguish them from drug-seekers or malingerers.
3. Since patients are distracted by extreme pain, they may not reliably volunteer a history of bladder/bowel disturbance.

CME

Post-test Quiz

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reversing motor deficits and rectal dysfunction and a 3.5 times reduction in the loss of sensory and sexual function. Clearly, there is no sudden physiological shift at 48 hours but earlier is better. Critical statistical analysis of Ahn's paper in fact argues for a 24-hours threshold.[14]

A recent series of 200 cases from one center also argued for 48 hours[15] but was criticized on the same basis as Ahn's analysis.[16] It is important to note that in this series, fully two thirds of the patients presented with only unilateral leg dominant pain.

Elderly patients with compensated lumbar spinal stenosis and chronic nerve root compression who present with difficulty walking and perhaps some incontinence must be screened with the question regarding change in bowel or bladder function. If there is even the slightest possibility of a massive central lumbar disc herniation producing acute CES, urgent referral is required. Recognizing the 48 hour timeline, it is advisable to contact the on-call spine surgeon. The lumbar MRI is the correct image. The CT scan typically focuses on a small area, commonly L3 to sacrum. The MRI covers the lower spine from T10 to the sacrum. While modern spiral CT scans are effective in detecting the common low lumbar disc hernias they can miss

CLINICAL PEARLS

1. Cauda Equina Syndrome is an acute or subacute pathology caused specifically by massive central prolapse of a lumbar disc. Decompensation lumbar spinal stenosis is not Cauda Equina Syndrome.
2. Cauda Equina Syndrome most commonly presents with complaints of back or leg pain. These differ from common sciatica in being rapidly progressive, difficult to control with analgesics and often associated with considerable locomotor impairment.
3. The neurological examination in Cauda Equina Syndrome most commonly finds a mixed pattern of incomplete polyradicular deficits in the distribution of multiple lumbar and sacral nerve roots involving either of the legs and/or the saddle (perineum). The classically described complete flaccidity with loss of all motor control from the waist down is extremely rare.
4. Patients presenting with CES will not commonly volunteer complaints of incontinence or urinary retention as they are often overwhelmed by the magnitude of their pain. The assessor must specifically ask about bowel/bladder function and when indicated, test these by bladder scanning or catheterizing and a digital rectal examination.
5. As a rapidly evolving syndrome of neurological deterioration, CES warrants emergent imaging investigation and referral. Although the literature is not precise on the critical time point, it is widely accepted that patients should receive surgical intervention within 24 to 48 hours.

more proximal pathologies. In Ahn's study,[13] less than half the discs were at L4/5 and L5/S1.

5. What are the Outcomes of Treatment for Cauda Equina Syndrome?

The CES literature is principally focused on the return of sphincter function however serious permanent pain, disability with locomotor impairment and sexual dysfunction are common.[1,9,10,13] A history of chronic low back pain predicts a worse outcome.[13] These risks are known and should be communicated to the patient. CES patients have a poorer prognosis than those treated for simple sciatica and patients must be made aware. Missing the diagnosis is below the standard of care and may lead to justified litigation. Misunderstanding the reduced possibility of a full recovery may lead the patient to unfounded accusations of inadequate treatment.[11,12,17]

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