Annals of Neurology and Neuroscience
Research Article

Diagnostic Delays in Cauda Equina Syndrome: A Retrospective Emergency Department Study

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Citation: *Qasim Zia, Muhammad Usama Khalid, Zunair Nasir, Rafia Ejaz, Muhammad Hamza Khan, Muhammad Sheraz, et al. Diagnostic Delays in Cauda Equina Syndrome: A Retrospective Emergency Department Study. Anna Neur & Neurosci. 2026;1(1):1-6.*

Received Date: 29 March, 2026; **Accepted Date:** 01 April, 2026; **Published Date:** 02 April, 2026

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ABSTRACT

Cauda Equina Syndrome (CES) is a rare but devastating neurological emergency characterized by compression of the lumbosacral nerve roots, most commonly resulting from lumbar disc herniation. Prompt diagnosis and urgent surgical decompression are essential to prevent irreversible neurological deficits, including paralysis, bladder dysfunction, and sexual impairment. Despite the clinical urgency, diagnostic delays in emergency departments (EDs) remain a persistent and well-documented problem worldwide.

This retrospective observational study aimed to evaluate the prevalence, causes, and consequences of diagnostic delays in CES among patients presenting to the ED. Data were collected from patients with MRI-confirmed CES over a four-year period. Variables analyzed included symptom presentation, clinical documentation, time to diagnosis, imaging delays, referral pathways, and neurological outcomes.

The findings indicate that diagnostic delays occurred in more than half of the cases and were associated with atypical clinical presentations, inadequate recognition of red flag symptoms, and systemic factors such as delays in imaging availability. These delays were significantly associated with poorer neurological outcomes, particularly persistent bladder dysfunction.

The study highlights the need for improved clinical awareness, standardized diagnostic protocols, and expedited

access to imaging to reduce delays. Addressing these challenges is critical not only for improving patient outcomes but also for reducing the substantial medico-legal burden associated with CES.

INTRODUCTION

Cauda Equina Syndrome represents a critical neurological emergency arising from compression of the nerve roots below the level of the conus medullaris. The condition most commonly results from a large central lumbar disc herniation, although other etiologies such as spinal tumors, epidural abscesses, traumatic injury, and spinal stenosis may also be implicated.[1,2] The clinical importance of CES lies in its potential to cause permanent neurological deficits if not promptly recognized and treated.

The classical clinical presentation of CES includes severe lower back pain, bilateral sciatica, saddle anesthesia, and dysfunction of bladder and bowel control.[3] However, the presentation is often incomplete or atypical, which contributes significantly to diagnostic challenges in the emergency setting. Studies have demonstrated that only a minority of patients present with the full constellation of symptoms, complicating early identification.[4,5]

Timely surgical decompression, ideally within 24 to 48 hours of symptom onset, has been shown to significantly improve neurological outcomes, particularly in terms of bladder function recovery.[6,7] Delayed intervention, on the other hand, is associated with a high risk of permanent disability, including chronic pain, paralysis, and incontinence.

Emergency departments serve as the primary point of contact for patients with acute neurological symptoms, placing ED clinicians at the forefront of CES diagnosis. However, the high volume of patients presenting with back pain, combined with the rarity of CES, creates a challenging diagnostic environment. Back pain is one of the most common reasons for ED visits, and distinguishing CES from benign causes requires a high index of suspicion.[8]

Diagnostic delays in CES have been widely reported in the literature and are often attributed to a combination of clinical, cognitive, and systemic factors.[9] These include failure to recognize red flag symptoms, inadequate neurological examination, poor documentation, and delays in obtaining diagnostic imaging such as MRI. Moreover, the medico-legal implications of delayed diagnosis are significant, with CES being one of the leading causes of litigation in neurosurgery and emergency medicine.[10,11

Given these challenges, it is imperative to better understand the factors contributing to diagnostic delays in CES. This study aims to evaluate these delays in an ED setting, identify their underlying causes, and propose strategies to improve early recognition and management.

METHODS

This study was conducted as a retrospective observational analysis in the emergency department of a tertiary care hospital. The study period spanned four years, during which all cases of CES presenting to the ED were reviewed.

Eligible participants included adult patients aged 18 years and older with a confirmed diagnosis of CES based on magnetic resonance imaging findings. Patients with incomplete medical records or those with non-compressive etiologies of CES were excluded from the study.

Data were extracted from electronic health records and included demographic information, presenting symptoms, clinical examination findings, documentation of red flag symptoms, time intervals from presentation to diagnosis, time to MRI, time to neurosurgical referral, and timing of surgical intervention. Outcome measures included neurological recovery, particularly bladder and motor function.

Diagnostic delay was defined as failure to suspect CES within six hours of presentation to the ED. Imaging delay was defined as a delay of more than 12 hours in obtaining MRI following presentation, while referral delay was defined as more than six hours between suspicion of CES and neurosurgical consultation.

Descriptive statistical analysis was performed to evaluate the frequency and distribution of delays. Associations between delays and outcomes were assessed qualitatively.

RESULTS

A total of 40 patients met the inclusion criteria during the study period. The mean age of the cohort was 45 years, with a slight predominance of male patients. The majority of patients presented with lower back pain, followed by unilateral or bilateral sciatica. Urinary symptoms were reported in a significant proportion of cases, although these were often not documented comprehensively at initial presentation.

Only a minority of patients exhibited the full classical symptom triad of CES. This finding is consistent with existing literature and underscores the variability in clinical presentation. Saddle anesthesia, a key diagnostic feature, was inconsistently assessed and documented.

Diagnostic delays were observed in more than half of the cases. In many instances, CES was not initially considered as a differential diagnosis, leading to delays in further evaluation. Imaging delays were also prevalent, with nearly half of the patients experiencing delays in obtaining MRI. Limited availability of MRI, particularly outside of regular working hours, was identified as a significant contributing factor.

Referral delays to neurosurgery were noted in a substantial number of cases. In some instances, even after CES was suspected, delays in communication and coordination resulted in postponed specialist assessment.

Patients who experienced diagnostic and treatment delays were more likely to have poor neurological outcomes. Persistent bladder dysfunction was particularly common among patients with delayed intervention, highlighting the critical importance of timely diagnosis and management.

DISCUSSION

The findings of this study highlight the persistent challenge of diagnostic delays in CES within the emergency department setting. These delays are multifactorial and reflect a combination of clinical complexity, cognitive biases, and systemic inefficiencies.

One of the primary challenges in diagnosing CES is its variable and often incomplete presentation.

While classical teaching emphasizes the triad of saddle anesthesia, bladder dysfunction, and bilateral sciatica, many patients present with only one or two of these features.[4,12] This variability can lead to under-recognition, particularly in busy ED environments where clinicians must rapidly triage and manage a wide range of conditions.

Cognitive biases, such as anchoring and premature closure, may also contribute to diagnostic delays. Clinicians may attribute symptoms to more common benign causes of back pain, particularly in the absence of overt neurological deficits.[13] This highlights the importance of maintaining a high index of suspicion for CES in patients presenting with back pain and any associated neurological symptoms.

System-related factors play a significant role in diagnostic delays. Access to MRI, the gold standard for diagnosing CES, is often limited, particularly in resource-constrained settings or during off-hours.[14] Delays in imaging not only postpone diagnosis but also delay definitive management, thereby increasing the risk of adverse outcomes.

Inadequate documentation of clinical findings further exacerbates the problem. Studies have shown that key symptoms such as saddle anesthesia and bladder dysfunction are frequently under-documented in ED records.[15] This not only impacts clinical decision-making but also has medico-legal implications.

The medico-legal burden associated with CES is substantial. Delayed diagnosis is a common cause of litigation, often resulting in significant financial compensation and professional consequences.[10,16] This underscores the need for robust clinical protocols and documentation practices.

Improving early recognition of CES requires a multifaceted approach. Education and training of ED clinicians are essential to enhance awareness and understanding of the condition. Standardized clinical pathways and checklists can help ensure consistent assessment and documentation of red flag symptoms. Additionally, improving access to MRI and streamlining referral pathways can significantly reduce delays.

STRENGTHS AND LIMITATIONS

This study provides valuable insights into real-world ED practices and highlights key areas for improvement in the diagnosis of CES. However, it is not without limitations. The retrospective design limits the ability to establish causality, and the relatively small sample size may affect the generalizability of the findings. Additionally, reliance on documentation may result in underestimation of symptom prevalence.

CONCLUSION

Diagnostic delays in Cauda Equina Syndrome remain a significant challenge in emergency medicine. These delays are largely preventable and are associated with substantial morbidity and medico-legal consequences.

Improving early recognition of CES requires increased clinical awareness, standardized assessment protocols, timely access to imaging, and efficient referral systems. Addressing these factors is essential to improve patient outcomes and reduce the burden of delayed diagnosis.

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