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Acute Conus Medullaris Syndrome Following Minimally Invasive Lumbar Discectomy: A Case Report with Narrative Review

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ABSTRACT

Introduction: Lumbar disc herniation is a common cause of low back pain, often managed surgically via discectomy. While generally safe, discectomy may result in rare but serious complications such as conus medullaris syndrome (CMS). Most reported cases of CMS develop days to months postoperatively due to mechanical compression or vascular anomalies. Immediate-onset CMS without radiological abnormalities is exceptionally rare.

Case Presentation: We report the case of a 43-year-old man who developed acute CMS following an uneventful L3/L4 tubular microdiscectomy that occurred within hours. The symptoms were bilateral foot drop, saddle anesthesia and urinary retention. On urgent MRI, the conus medullaris was free of any compressive lesions or signal changes. Clinical follow-up showed a dramatic improvement in neurological status of the patient.

Conclusion: This case provides evidence to transient microvascular ischemia that may be involved in acute CMS presentation without radiologic abnormalities. Prompt clinical identification, use of perfusion imaging, and hemodynamic support may enhance outcomes in similar presentations.

Keyword: Conus medullaris syndrome, microdiscectomy, lumbar spine, spinal ischemia, postoperative complication

1. INTRODUCTION

Lumbar disc herniation is one of the most common structural causes of low back pain, a condition that remains the leading contributor to years lived with disability globally [1,2]. Surgical discectomy—whether open, microscopic, or endoscopic, is a widely performed intervention aimed at relieving nerve root compression [3,4]. The adoption of minimally invasive spine surgery (MISS) techniques, including tubular microdiscectomy and percutaneous transforaminal approaches, has increased in recent years due to their potential to reduce soft tissue disruption and shorten recovery time [5,6]. Despite these advancements, complications such as dural tears, radiculitis, and new motor deficits remain recognized postoperative risks [7,8]. Conus medullaris syndrome (CMS) is a rare but devastating neurological condition, which can present bilateral lower limb weakness, saddle anaesthesia and sphincter disturbance. The majority of cases reported in the literature have been CMS presenting between days and months after surgery and are typically because of late mechanical compression (which may include spinal dural arteriovenous fistulae (SDAVFs)) or infarction [9–11]. Hence, our report of CMS in early postoperative period, non—imaging abnormalities is even more rare.

However, we report a case of CMS of sudden onset following an otherwise uneventful L3/L4 tubular microdiscectomy. The lack of intraoperative complications or postoperative compressive lesions and normal early MRI suggests transient vascular dysfunction. This case contributes to the scarce literature and emphasizes early recognition, perfusion imaging, and hemodynamic stabilization for the treatment of acute postoperative spinal cord dysfunction

2. CASE REPORT/CASE PRESENTATION

A 43-year-old male presented with five months of sharp, electric-like pain radiating from the left gluteal region to the anteromedial knee, with intermittent numbness. Neurological examination was normal, except for a positive straight-leg-raise test at 60° on the left. Lumbar MRI showed a left L3/L4 paracentral and foraminal disc extrusion compressing the L4 root, without conus signal abnormality. After failed conservative therapy, the patient underwent minimally invasive L3/L4

discectomy and foraminotomy. No durotomy or hemorrhage occurred (estimated blood loss <50 mL), though anesthesia records documented a 15-minute systolic hypotension at ~70 mmHg. Postoperatively, he developed bilateral foot drop and ascending numbness, evolving to saddle anesthesia and urinary retention within 12 hours. Emergent MRI showed no compressive pathology or conus signal changes. Within 48 hours, proximal strength improved to MRC 3/5. Nerve conduction studies at four weeks showed bilateral L5–S1 radiculopathy. By one month, the patient regained independent ambulation using an ankle-foot orthosis; autonomic function normalized. Six-month MRI (Figure 1, Figure 2)

showed resolved lateral recess stenosis without conus atrophy. At one-year follow-up, mild dysesthesia and cold-warm misperception in the left lower limb persisted.

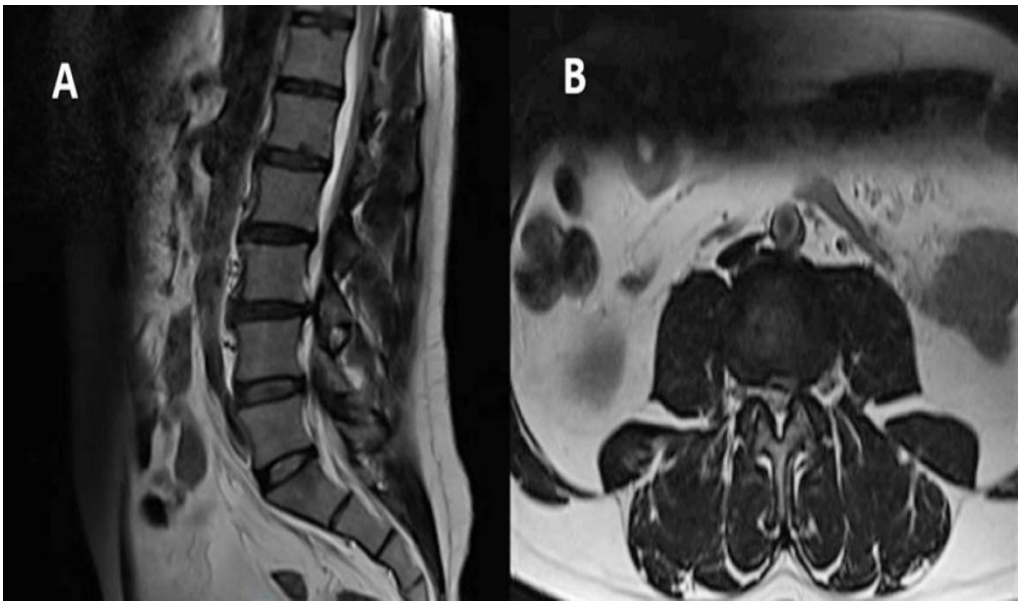
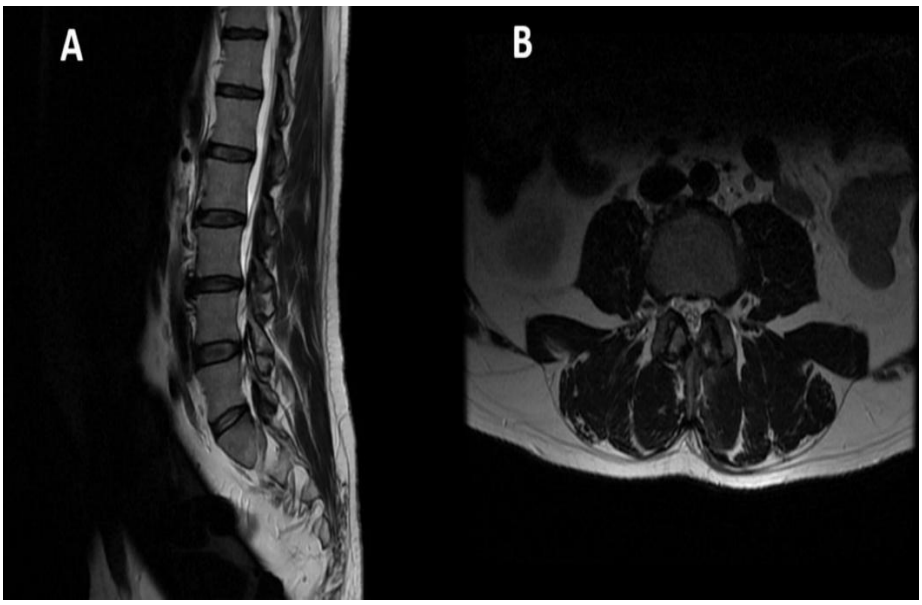


Figure 1. Preoperative lumbar MRI showing L3/L4 disc extrusion.

(A) Axial T2-weighted image at L3/L4 demonstrates a left paracentral and foraminal disc fragment compressing the traversing L4 nerve root (white arrow).
(B) Sagittal T2-weighted image shows preserved disc height and normal conus position at L1, without cord or cauda equina signal abnormalities.



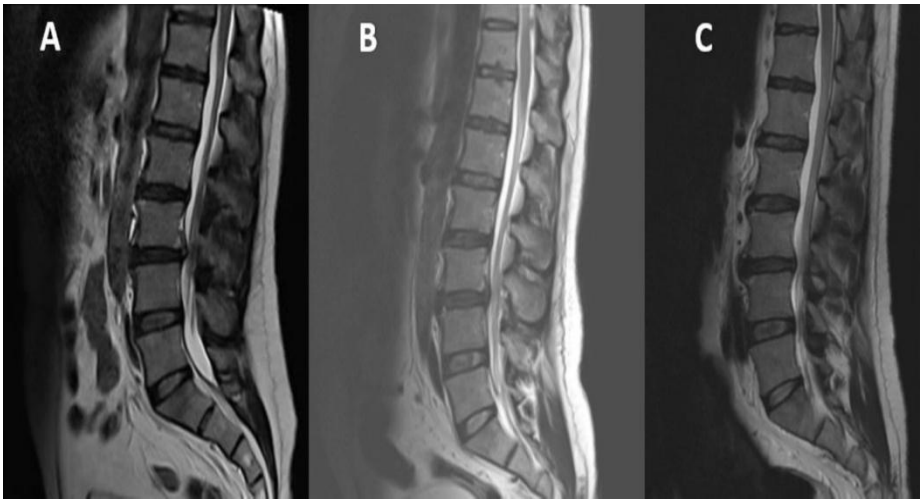


Figure 2. Serial postoperative lumbar MRI, showing decompression and stable conus morphology.

(A) Sagittal T2-weighted image from T10 to S2 at six months post-op shows resolved L3/L4 compression and normal conus signal.
(B) Axial T2-weighted image at L3/L4 confirms decompression without residual disc, hematoma, or fluid. (C–E) Sagittal T2-weighted images at the conus medullaris level at three timepoints: preoperative (C), immediate postoperative (D), and six-month follow-up (E), demonstrating stable conus morphology with no edema, atrophy, or signal change.

3. NARRATIVE REVIEW

A targeted literature review was conducted using PubMed, Scopus, and Google Scholar with the Boolean string "(conus medullaris OR conus syndrome) AND (lumbar discectomy OR microdiscectomy OR endoscopic discectomy)," yielding 194 results. After duplicate removal and multistage screening, only four single-patient reports met contemporary diagnostic criteria for post-discectomy CMS. These four, along with the present case, represent the current documented evidence base for this rare postoperative complication and are summarized in Table 1.

Table 1. Summary of reported CMS cases following lumbar discectomy

[Ref]	Age/Sex	Disc Level & Approach	Latency to CMS	Mechanism	Key Imaging	Neurologic Outcome
Asakuno et al. [8]	60/M	L5/S1 open HLD	14 mo	Iatrogenic SDAVF at S1 root sleeve	Conus edema; serpentine vein on DSA	Partial gait/sphincter recovery after fistula excision
Stevens et al. [9]	53/M	L4/5–L5/S1 micro-D	3 mo	Pre-existing SDAVF unmasked by surgery	Flow-voids on T2; DSA positive	Moderate recovery (Frankel D) post-endovascular occlusion
Ouyang et al. [13]	59/M	L4/5 open D	8 yrs	Acquired SDAVF at laminectomy site	Cord swelling; venous pouch; DSA positive	Marked improvement post-ligation
Kramer et al. [10]	56/M	L4/5 MIS-D	24 h	ASA infarct (no AVM)	DWI: restricted diffusion; T2 ↑	Severe paraparesis despite re-exploration
Present case	43/M	L3/4 tubular MIS-D	<3 h	Probable transient micro-ischaemia	MRI normal; NCS radicular	Near-complete recovery at 3 months

This table summarizes published cases of CMS following lumbar discectomy. Data include patient demographics, surgical level/approach, latency to symptom onset, suspected mechanisms, imaging findings, and outcomes.

Abbreviations:

CMS = conus medullaris syndrome; SDAVF = spinal dural arteriovenous fistula; HLD = herniated lumbar disc; MIS = minimally invasive surgery; D = discectomy; DSA = digital subtraction angiography; NCS = nerve conduction studies; DWI = diffusion-weighted imaging; ASA = anterior spinal artery; AVM = arteriovenous malformation.

Kramer et al. [14] described a case of CMS occurring within 24 hours post L4/5 MIS-D, with an acute bilateral lower limb weakness and urinary retention. MRI demonstrated diffusion restriction at the conus on DWI, which suggests infarction in the ASA territory. On the other hand, he presented after 3 h of symptoms that included bilateral foot drop and urinary disturbances; however, conventional T2-weighted MRI and DWI showed no notable findings. This imaging-negative phenomenon, along with marked neurologic recovery, is more typical of transient perfusion failure or neurapraxia rather than permanent ischemia.

The five published cases, including ours, reveal three phenotypic patterns: SDAVF-associated venous hypertensive CMS, typically delayed and characterized by flow-voids on T2-weighted MRI; ASA-related infarction, with rapid onset and restricted diffusion on DWI; and hyperacute, imaging-negative CMS with symmetric deficits and favorable recovery. The latter phenotype is best explained by brief, reversible microvascular compromise, as observed in animal models of transient cord ischemia without structural damage.

The true incidence of CMS after MIS-D remains unknown. No prospective MIS registries have documented this entity and its low frequency may be attributable in part to underdiagnosis. Furthermore, for none of these four previous cases perfusion-sensitive sequences (e.\g. DWI or dynamic contrast-enhanced MRI) had been used indicating that there is still a great deficit in the diagnostic imaging method. More frequent use of these modalities could demonstrate transient ischemic syndromes not seen with standard MRI alone.

4. DISCUSSION

CMS after lumbar discectomy is a rare and underreported postoperative complication. Most documented cases involve delayed onset and are attributed to SDAVFs, which typically present with progressive bilateral weakness, early sphincter dysfunction, and serpentine flow-voids on T2-weighted MRI, with partial neurological recovery after surgical disconnection [1,2]. Ischemic causes, particularly arterial, are less common. Kramer et al. reported a case of acute conus infarction post-L4/5 discectomy, with restricted diffusion on DWI and poor outcome [3]. Mechanical etiologies, such as migrated disc fragments or hematoma, usually have radiological correlates [4–7].

Our patient developed abrupt bilateral deficits hours after surgery. Postoperative MRI showed no compression or cord signal abnormality. The symmetric onset and rapid partial recovery support a transient ischemic event rather than infarction or compressive neuropathy. Animal models demonstrate that brief vasospasm can cause reversible spinal conduction block without radiological changes if perfusion is promptly restored [8]. DWI is more sensitive than conventional MRI for detecting early ischemia [9].

Anesthesia course was complicated by temporary intraoperative hypotension (SBP ~70 mmHg for 15 minutes). While no technical problems emerged and transient microvascular hypoperfusion (potentially aggravated by mechanical retraction) could account for the imaging-negative CMS. Early DWI or perfusion sequences might have detected changes that were overlooked on T2-weighted MRI. Close hemodynamic monitoring during surgery is essential at the conus.

DSA, the gold standard for SDAVF diagnosis, was meanwhile not considered in view of its rapid recovery. However, DSA should be applied in reluctant or ambiguous cases due to the fact that as much as 30% of spinal vascular lesions are overlooked on MRIs [10]. We continued PO-MAP > 75 mmHg in accordance with treatment protocols of spinal perfusion [11]. CSP was confirmed by NCS with bilateral involvement of L5–S1, but EMG was not done. EMG should be included in future protocols to distinguish spinal cord, plexus, and root-level pathology as recommended by the AANEM [12].

5. CONCLUSION

CMS represents a rare yet potentially devastating complication of lumbar discectomy, particularly in acute, imaging-negative presentations. This case underscores the importance of early clinical suspicion, early perfusion-directed therapy, as well as advanced imaging including diffusion/perfusion MRI and electromyography to guide management—to improve outcomes. Due to the paucity of published cases, there is a great need for prospective multicenter registries that answer questions about underlying pathophysiology, risk factors, and evidence-based management paradigms.

CMS reflects an unusual but potentially tragic sequel of lumbar discectomy, especially as the time taken from symptoms to definitive operation is reduced. Hence, this serves as a lesson to maintain early clinical suspicion and immediate perfusion-directed care and advanced diagnostics including diffusion/perfusion-MRI and electromyography for optimal outcome after carotid dissection. Considering that few cases have been reported, prospective multicentric registries are urgently needed to

shed light on the mechanisms, risk factors and evidence-based management strategies.

Statements

Patient Perspective

The patient expressed relief at the prompt medical attention and reported satisfaction with the recovery process. He emphasized the importance of early recognition and remained optimistic about his long-term neurological outcome.

Statement of Ethics

This case report was conducted in accordance with the Declaration of Helsinki. Ethics approval was waived by the Institutional Review Board of Al-Balqa Applied University, Faculty of Medicine, Al-Salt, Jordan. Written informed consent was obtained from the patient for participation and for publication of the clinical details and accompanying images.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

B.I. contributed to the conception, design, data collection, analysis, and drafting of the manuscript. A.A., M.Y.H., M.N., and W.F.D. contributed to data acquisition and critical revision of the manuscript. All authors reviewed and approved the final version of the manuscript.

Data Availability Statement

The data that support the findings of this case report are not publicly available due to patient privacy and institutional restrictions, but are available from the corresponding author upon reasonable request

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