

Case Report

Lumbar drain associated radiculoplexopathy in a patient with spontaneous cerebrospinal fluid rhinorrhea: a proposed checklist

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ABSTRACT

Continuous lumbar drainage (LD) is often performed along with endoscopic cerebrospinal fluid (CSF) rhinorrhoea repair. They serve various functions, such as offsetting the pressure over the repair site, decreasing the CSF pressure gradient across the repair site, and facilitating graft adhesion. However, their insertion may cause neurological sequelae due to displacement, breakage, or dural trauma at the site. The authors present a case of a rare complication of LD insertion where the patient developed lumbar plexus neuropathy due to an epidural CSF collection. Imaging and neurological assessment helped with the diagnosis, while device removal with bed rest resolved the symptoms. There is a paucity of literature on this complication in adults, and this report describes the presentation, management, and treatment of this problem along with a suggested checklist.

Keywords: Lumbar drain, CSF rhinorrhea, Radiculopathy, CSF rhinorrhea repair, Cerebrospinal fluid

INTRODUCTION

Cerebrospinal fluid (CSF) rhinorrhea is a well-known clinical entity wherein abnormal communication between the subarachnoid spaces and the nasal cavity is present. Classified as either traumatic, spontaneous, or iatrogenic, the treatment aims to identify and close the defect in the skull base,¹ although conservative management with bed rest, prophylactic antibiotics, and acetazolamide can be initially tried for traumatic leaks. Lumbar drains have been used to augment the success rates of skull base repairs by reducing cerebral oedema, facilitating cerebral relaxation, and thus reducing the pressure gradient across the repair site, enhancing graft uptake and adhesion.² However, placement of LD catheter in the subarachnoid space at the L3-L4 level has additional challenges. Although rare, catheter misalignment, displacement, and impingement on nerve roots have been reported in the literature. This case reports a rare neurological complication following an inadvertent CSF leak into the

epidural space after LD catheter insertion at the L3-L4 level.

CASE REPORT

A middle-aged female presented with spontaneous bilateral CSF rhinorrhoea. Multiple defects were identified on imaging and intraoperatively at the right ethmoid roof and bilateral cribriform plates (Figure 1). She underwent bilateral multi-layered endoscopic defect repair with LD insertion. Before the commencement of surgery, attempts were made to insert a lumbar drain at the L4-5 interspace with an 18G needle. However, obtaining access to the subarachnoid space was difficult; after multiple attempts, the catheter was secured and fixed. The opening CSF pressure was 19.03 cm of water (14 mm Hg). She was on complete bed rest after the procedure, and the postoperative days 1 and 2 were uneventful. On day 3, the patient developed impaired voluntary motor activity associated with tingling and paraesthesia and shooting pain along the right leg with no

bladder complaints. A leak was also noticed at the site of LD insertion.

An urgent neurological examination revealed a radiculopathy-plexopathy of L1-L4 segments. There was reduced power of the right lower limb, absent knee jerk, and sensory loss to touch over L2-L4 dermatomes. An MRCT (MRI and CT non-contrast in axial, sagittal and coronal views) of the lumbosacral spine revealed a lumbar, thoracic, and ventral cervical extradural CSF leak. The thecal sac was displaced anteriorly, with CSF collecting behind it in the epidural space. There was clumping of cauda equina nerve roots and a suggestion of hemosiderin staining on the nerves (Figure 2). There was no spinal cord infarcts detected on the MRI.

Based on the clinical and radiological features alone, the following differentials were considered: An impingement syndrome such as a prolapsed intervertebral disc may have caused such a spectrum of symptoms, given the patient's age and clinical profile.

However, there were no upper motor neuron signs in the patient. A retained piece of the lumbar subarachnoid

catheter causing an irritation of the nerve roots was also considered, since multiple attempts at insertion were there. However, there were no missing pieces of the catheter on removal, so this possibility was effectively ruled out. Cauda equina syndrome was a clinical possibility as well, however absence of back pain indicated other causes. Spinal cord infarcts and spinal vascular malformations were ruled out on imaging.

Based on the imaging findings, the LD was removed to avoid further injury. Periodic neurology examinations, electromyography, and nerve conduction studies were done, both of which were normal.

After eight days, she regained her motor and sensory power gradually. She was made to sit up initially on the bed, followed by supervised ambulation in the ward itself. She returned to her normal activities of daily living within 14 days of discharge.

She was discharged with instructions on monitoring her lower limb sensations and any signs of motor deficits. On follow-up at three months, there were no sensory or motor deficits.

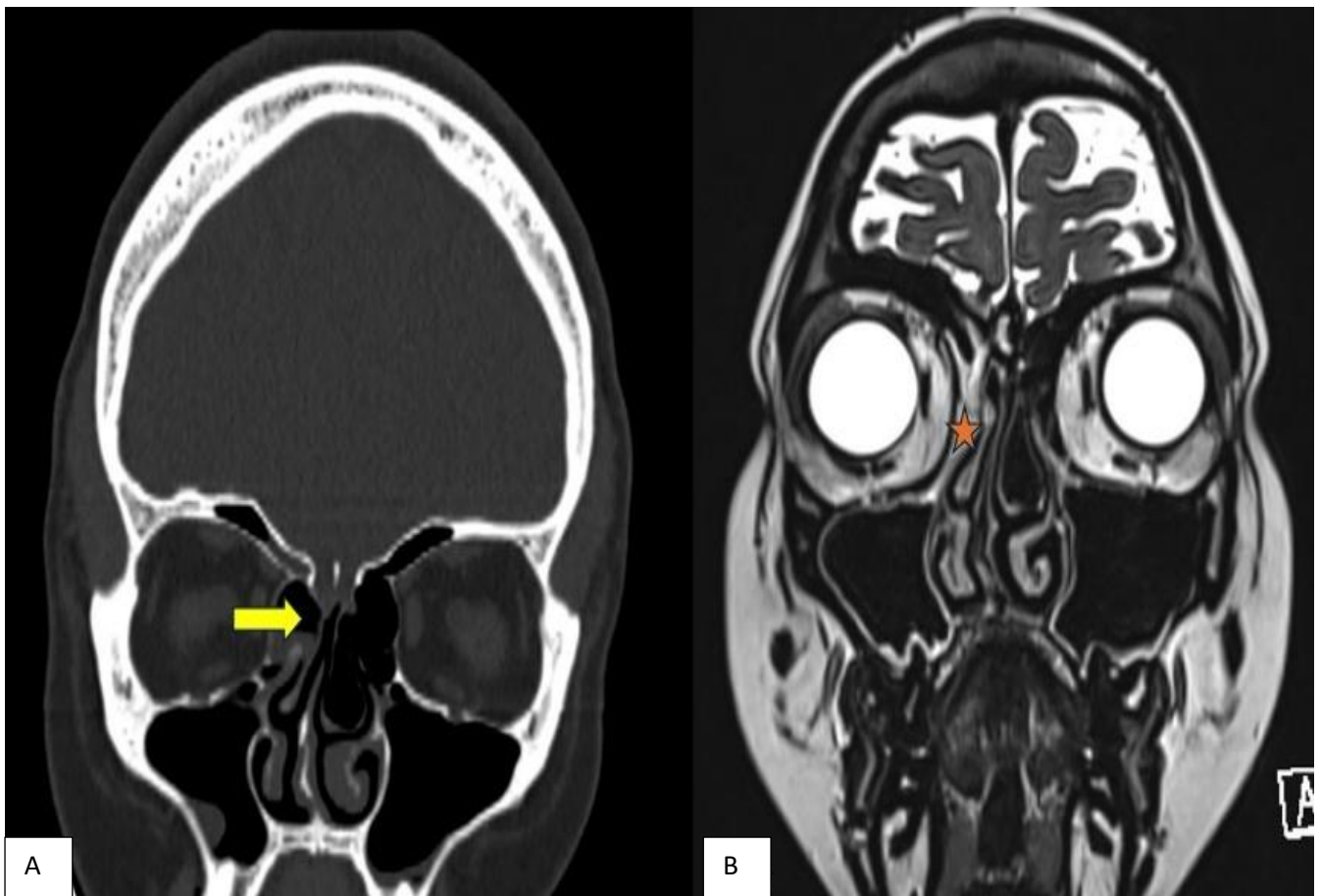


Figure 1 (A and B): A: Non contrast CT scan coronal view showing the site of the defect in the right ethmoid roof and rarefaction of both cribriform plates suggestive of sites of CSF rhinorrhoea (yellow arrow). B: MRI drive sequence coronal view image showing CSF signal herniating through the right cribriform plate suggestive of a skull base defect (red asterisk).



Figure 2: MRI sagittal spine without contrast taken postoperatively: T2 weighted image.

*It shows lumbar extradural CSF leak features with collection posterior to the thecal sac in the epidural space. Clumped cauda equina nerve roots with hemosiderin staining are seen (yellow arrow).

A. Pre-Procedural and Procedural Considerations:

- Use lumbar drainage (LD) only in cases where the benefits outweigh the risks
- Obtain and document informed consent regarding neurological complications
- Performed or overseen by an experienced practitioner
- Minimize the number of attempts at lumbar puncture. If resistance is encountered or CSF flow is not achieved quickly, consider an alternative level or a more experienced operator
- Check for free, non-blood-stained CSF flow before advancing the catheter
- Securely fix the catheter in order not to let any possibility of migration or shifting
- Document the spinal level, depth of catheter insertion, number of attempts, any difficulty with the procedure, and the presence of bloody or traumatic tap

B. Immediate Postoperative Monitoring:

- Perform a thorough postoperative neurological examination, including motor strength, sensation (dermatomal assessment), tendon reflexes, and bladder/bowel function¹⁰
- Establish a clear baseline against which comparisons can be made in the future
- Check patency, ensure controlled drainage (if rates are set), and check for leakage at the insertion site
- Watch for abnormal drainage, either leaking much too quickly, bloody CSF, or no drainage at all

C. Early Detection of Complications: Warning Signs or Device Malposition:

- New or progressive back/leg pain, radicular (shooting) pain, paresthesia, numbness, or weakness in the lower limbs
- Changes in reflexes, for example, loss of knee jerk; sensory deficits in a dermatomal pattern
- Fluid leakage or swelling at the site of catheter insertion
- Unusual headache or neck stiffness, raising suspicion of meningeal irritation¹¹

D. Diagnosis and Evaluation:

- Urgent Neurologist/Neurosurgical Consultation:**
Perform a detailed mental status examination, motor strength assessment with formal grading, sensory mapping, reflexes, and bladder/bowel function
- Imaging Studies:**
 - MRI of the Spine (Preferred): Assess for the presence of epidural collections of CSF, catheter migration, hematoma formation, nerve root compression, or development of pseudo meningocele¹²
 - MR Myelography or CT Myelography: Consider if MRI is unavailable or contraindicated
 - Plain X-rays: These may be done quickly to assess catheter placement but are less sensitive
 - Ultrasound: Useful in detecting superficial fluid collections but less definitive than MRI

A

E. Management Strategies Based on Findings:

- Confirming the Cause:**
 - Consider a dural tear and a "ball-valve" type mechanism resulting in pseudo meningocele if MRI demonstrates an epidural collection of CSF displacing the thecal sac and causing radiculopathy
 - Consider immediate removal or repositioning if the catheter is kinked, malpositioned, or broken
- Catheter Management:**
 - Immediate Removal:**
 - For significant neurological deficits with imaging confirmation of compression, remove the catheter without delay to decompress
 - For suspected catheter fragmentation, consider image-guided removal (e.g., CT or ultrasound guidance)
 - Planned Removal:**
 - When deficits are mild and stable, with only a small amount of epidural collection, removal can be scheduled after clinical improvement or stabilization
- Reinsertion Considerations:**
 - If papilloedema persists or IIH remains uncontrolled after catheter removal, consider cautious reinsertion at a different level or other CSF diversion modalities
- Conservative Treatment Measures:**
 - Mild deficits: Bed rest, analgesics for pain, and close neurological monitoring
 - Neurological reassessment periodically (e.g., every 4-6 hours initially, then daily as stabilized)¹³
 - EMG/NCS studies if symptoms persist or to document recovery
- Surgical Intervention (if needed):**
 - Rarely, in cases of sizeable progressive pseudo meningocele or persistent radiculopathy not improving with conservative measures, surgical drainage and direct dural repair should be considered

F. Long-Term Follow-Up and Prevention:

- Monitoring After Removal:**
 - Continue periodic neurological examinations until deficits resolve or stabilize
 - Arrange outpatient follow-up for those with persistent or delayed recovery
 - Physiotherapy may be required for residual weakness¹⁴
- Quality Improvement Measures:**
 - If a complication occurs, consider reviewing procedural details and modifying practices. This may include using smaller bore catheters, real-time imaging guidance, or stricter criteria for LD placement
 - Provide feedback and training to reduce future complications

G. Outcome Assessment:

- Recovery and Discharge Criteria:**
 - Neurological deficits resolved or significantly improved
 - Stable imaging findings demonstrated decreasing or stable epidural collections
 - Repair of the CSF leak without recurrent rhinorrhea

B

Figure 3 (A and B): A: Pre-procedural checklist, diagnosis and early evaluation. B: Post complication management and outcome assessment measures.

*Proposed treatment algorithm for management lumbar drain associated lumbar radiculoplexopathy at a tertiary/quaternary care center. The figures in superscripts indicate the references as mentioned in the reference list with the manuscript.

DISCUSSION

Despite being widely used for its supportive role in managing CSF leak closure, there is no clear consensus on the indications and duration of insertion of LD in these patients. A meta-analysis by Guo et al.³ mentions that LD benefits high-flow leak cases despite its attendant complications. Documented complications can be both during and post-procedure. This includes pneumocephalus, traumatic tap causing neuraxial hematomas, kinking, breakage, and retention of fragments.⁴ Post-procedure minor complications include headache, nausea, vomiting, and over and under-drainage. Major complications include infection, meningitis, trans-tentorial herniation, and radiculopathy. Subarachnoid haemorrhage is reported due to tearing of vessels within the subarachnoid space.⁵

Radiculopathies and plexopathies are some of the potential complications due to impingement on the nerve roots by any CSF drainage device. It has been described after neurosurgical and spinal procedures secondary to trauma, displacement of catheters, and dural tears. Pseudo-meningocele-causing radiculopathy is an uncommon complication described following spine surgery and occurs due to iatrogenic injury to the dura. The swelling at the site, if any, may be drained surgically or may resolve with conservative measures.⁶ Epidural CSF collection causing radiculopathy is an infrequent complication following LD insertion. This is seen more in paediatric age groups than adults.⁷ The patient in our report had multiple attempts at lumbar puncture for the LD insertion and probably developed a dural tear leading to a slow epidural CSF collection, which was also leaking to the exterior along the LD at its insertion at L4-L5. A small dural tear is probably a one-way "ball-valve," resulting in pseudo-meningocele formation in the epidural space.⁸ Symptom detection might get delayed as patients on LD are kept on bed rest.

Imaging studies are necessary to determine the location of the lumbar catheter, especially in cases where a catheter displacement is suspected. A complete neurological examination is mandatory to identify the presence of associated motor or sensory deficits. An MRI of the spine will help in identifying the site and extent of neural impingement, haemorrhages, cord oedema, and other possible pathologies causing nerve root impingement.

The treatment is primarily conservative, with bed and rest analgesics for pain and serial, complete neurological examination. Catheter removal should be done carefully and after imaging. Care should be taken to avoid leaving behind the tip of the catheter in the subarachnoid space or further accidental penetration, risking further damage.⁹ More significant and progressive collections, however, require surgical drainage and closure of dural defects. The authors suggest a treatment checklist and algorithm

for managing such LD-related complications in a tertiary or quaternary referral centre (Figure 3 A and 3B).

The checklist aims to resolve any ambiguities in case selection and management of postoperative radiculoplexopathies related to LD insertion or position. Since a vast majority of such patients are usually admitted under otolaryngology services, it is prudent that ENT clinicians identify and manage such complications early when they arise. Clear guidelines should be instituted regarding the indications for an LD in the first place. Minimising the number of attempts at the puncture reduces the risk of this complication. Periodic postoperative monitoring is crucial, and the CSF drainage bag should be thoroughly checked in the recovery area and in the ward as well. Imaging is an adjunct to clinical examination in case of a suspicion of any neurological deficit. MRI is the imaging modality of choice. Catheter removal should be done after confirming the cause, and re-insertion should be carefully considered based on the persistence of IIH (Idiopathic intracranial hypertension). Conservative management is usually successful. EMG (Electromyography) and NCS (Nerve conduction studies) should be done if symptoms persist and to document recovery. Surgical repair is rarely required. Monitoring and follow up of the patient should be stringent to assess the resolution of the neurological deficit and for quality control purposes.

This article discusses a rare complication and proposes a treatment algorithm to manage the same. A multidisciplinary team should be involved in all such cases. Imaging is helpful and augments sound history and bedside clinical examination to diagnose this complication with accuracy. Further studies are indicated in this direction to improve patient care and management of LD related neurological complications.

CONCLUSION

The case highlights a potential neurological complication following surgery for CSF rhinorrhea repair. Prompt recognition of the condition by clinical examination is the key to management. Lumbar drain insertion itself is a potentially risky procedure, due to the proximity to surrounding critical neural structures in the lumbosacral spinal cord. Radiculopathy due to epidural CSF collection following LD insertion is an infrequent complication in patients undergoing CSF rhinorrhoea leak repair.

The surgeon should know this and initiate appropriate management protocols, as conservative management is required only if detected early. ENT surgeons are the foremost in the management of patients of CSF rhinorrhea. A checklist is helpful in selecting indications and management of radiculoplexopathies when they arise. Lumbar drain insertion should be clearly indicated. Case-by-case decision making should be undertaken by a multi-disciplinary team.

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