Management of Pseudomeningoceles after Surgery or Trauma

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Abstract

Pseudomeningocele, a post-operative or post-traumatic cerebrospinal fluid (CSF) collection from a dural defect, is an underrecognized complication following spinal or cranial surgery. Incidence varies from 0.07 to 2% in lumbar and up to 23% in posterior fossa procedures. While many resolve spontaneously, symptomatic cases can cause headaches, radiculopathy, or infection, necessitating stepwise management. Diagnosis relies on magnetic resonance imaging findings of fluid continuity with the subarachnoid space. Asymptomatic, small pseudomeningoceles are managed conservatively through bed rest, abdominal binder, analgesics, and serial imaging. Persistent or enlarging lesions require CSF diversion (lumbar drainage), epidural blood patch, or aspiration. Surgery is indicated for refractory cases or complications, emphasizing watertight dural repair using non-absorbable sutures, duraplasty with autologous fascia or synthetic graft, and myofascial flap reinforcement. This structured, evidence-based algorithm integrates conservative, interventional, and surgical strategies to guide clinicians in effectively managing postoperative and post-traumatic pseudomeningoceles.

Keywords: Pseudomeningocele, dural tear, lumbar.

Introduction

Postoperative and post-traumatic pseudomeningocele is not an uncommon complication following spinal procedures, with reported incidences varying significantly across different studies. The incidence of post-operative pseudomeningocele after lumbar spine surgery ranges from 0.07% to 2% [1]. With some studies reporting rates as high as 13% when including all cerebrospinal fluid (CSF)-related complications. In posterior fossa surgeries, the incidence can reach 4–23% [2]. Despite these relatively significant rates, most cases remain asymptomatic and underreported, as surgeons may be reluctant to document this complication and many resolve spontaneously. There exists a notable paucity of literature regarding standardized management approaches, with most evidence limited to case reports and small retrospective series. At present, no established algorithm or guideline exists for the systematic management of post-traumatic or postoperative pseudomeningocele, leaving clinicians to rely on individualized, symptom-driven approaches extrapolated from limited case experiences and expert opinion rather than evidence-based protocols.

Here is a clinically relevant algorithm for managing pseudomeningocele after spinal surgery, synthesised from current literature and expert practice [3].

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Algorithm: Post-operative Pseudomeningocele Management

Step 1: Diagnosis

• Confirm pseudomeningocele with magnetic resonance imaging/computed tomography (MRI/CT) and correlate clinically [4].

Confirmation of Pseudomeningocele: Investigations and Clinical Examination

Clinical examination

Pseudomeningocele is often identified as a fluctuant, palpable subcutaneous lump at the surgery or trauma site (Fig. 1). Key clinical findings include headaches caused by collection palpation, back discomfort, radicular complaints, and, on occasion, neurological abnormalities. The swelling may show positive transillumination and produce symptoms when compressed, indicating CSF hypertension [5].

Imaging investigations

Imaging Investigations: MRI remains the gold standard, with distinctive low signal intensity on T1-weighted pictures and high signal intensity on T2-weighted sequences, which are identical to CSF elsewhere. Direct visualization of connectivity with the subarachnoid region as a fluid tract or jet artefact on T2 sequences is one of the most critical diagnostic findings (Fig. 2). CT scans show hypoattenuating collection with CSF-equivalent attenuation and negligible peripheral enhancement [6].

Step 2: Assess symptoms and size

• Asymptomatic and small: No neurological deficit, mild or no pain [7].

• Symptomatic or large: Headache, neurological symptoms, increasing size, infection, or wound issues [8].

Symptomatic pseudomeningoceles are frequently associated with headache due to occasional CSF hypertension from compression or CSF hypotension from persistent leakage, resulting in holocranial, posture-specific pain that worsens upright and relieves reclined. Associated symptoms may include syncope, nausea, photophobia, and visual abnormalities. Neurological symptoms develop when growing collections compress neural tissues, resulting in radicular pain, sensory abnormalities, or motor paralysis; uncommon instances report acute myelopathy, decerebrate stiffness, and brainstem compression with coma [9].

Progressive expansion, sometimes caused by a ball-valve mechanism, indicates that conservative management has failed; pseudomeningoceles larger than 5 cm or with growth lasting more than 1–2 weeks require surgery to avoid a mass effect on the spinal cord, trachea, or esophagus in cervical region [10]. The risk of infection increases with prolonged CSF accumulation, leading to meningitis and chronic wound infection; infection rates in afflicted individuals have reached over 46%. Wound issues include breakdown and CSF fistula development, which hamper wound healing, increase infection risk, and might require multiple revisions [11].

Step 3: Initial management

Asymptomatic and small

• Observation and serial imaging [12]

• Bed rest, use of abdominal binder [4].

Conservative care is the primary choice of treatment for individuals with asymptomatic or slightly symptomatic pseudomeningoceles that do not cause substantial neurological impairments or active CSF leaking. Initial observation along with regular clinical examinations is recommended, since many pseudomeningoceles resolve spontaneously over time, with research indicating that 73.5% of cases recover without intervention [13]. Serial imaging with magnetic resonance imaging (MRI) or CT scan measures lesion size, mass effect, and spontaneous resolution. Clinical evaluations use headaches, photophobia, radicular pain, neurology and wound integrity to guide treatment options [8].

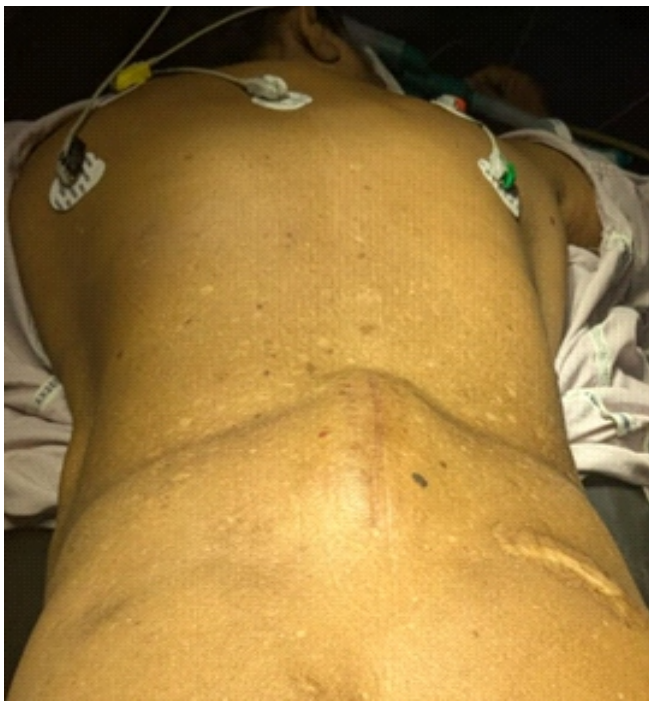

Figure 1: Globular swelling in pseudomeningoceles in lumbar region.

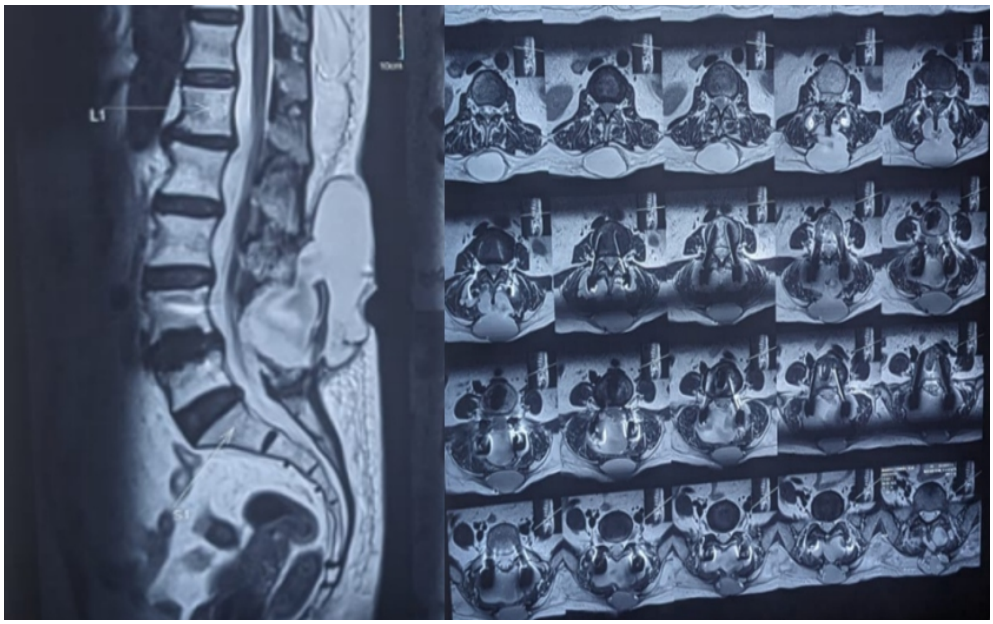

Figure 2: Magnetic resonance imaging films of the patient showing pseudomeningocele post-surgery – at L45 level.

Mild symptoms without compression

• Conservative: Analgesics, hydration, and close follow-up [12].

Asymptomatic and small pseudomeningoceles are frequently handled noninvasively, with cautious observation rather than urgent treatment. Pseudomeningoceles should be treated conservatively with analgesics to relieve symptoms, enough hydration to maintain appropriate intravascular volume and CSF production, and attentive clinical follow-up. Patients should be observed weekly for the first month to check symptoms and pseudomeningocele size, then evaluated monthly for the next 3 months. Long-term monitoring may last up to 6 months, with imaging scans performed as clinically necessary to check for resolution or progression. The first care comprises of surveillance with serial imaging, often MRI at regular intervals, to verify that the collection remains stable or resolves itself. During this time, patients are encouraged to lie back in bed to prevent CSF dynamics that might increase the sac and symptom provocation. An abdominal binder offers external support by raising intra-abdominal pressure, which reduces CSF leaking through the dural defect [14].

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Step 4: Interventional management

Persistent symptoms OR enlarging pseudomeningocele

• Lumbar subarachnoid drainage: Temporary CSF diversion for 3–4 days [15].

Lumbar subarachnoid drainage is a temporary CSF diversion procedure used to treat symptomatic or growing pseudomeningocele. A lumbar drain diverts CSF externally for 3–4 days, reducing pressure at the dural defect location and facilitating dura repair. Typical daily drainage rates vary between 5 and 10 mL/h; careful monitoring prevents problems such as herniation or infection. This method is frequently used in conjunction with primary dural repair and myofascial flap support in surgically treated situations. Typically, on the third day of the drain, it is clamped for 24 h to check for leakage from the wound site before being removed. The therapy has proven to be helpful in clearing collections and promoting wound healing while reducing the chance of recurrence [16].

• Epidural blood patch: For mild-to-moderate leaks not

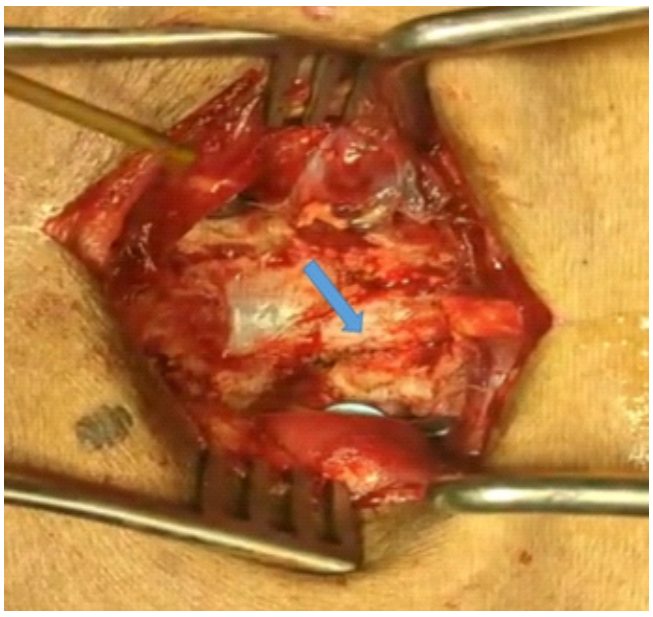

Figure 3: Direct open repair of dura site of repair shown with an arrow.

Table 1: Algorithm providing a structured approach for managing pseudomeningocele after spinal surgery, balancing conservative and interventional steps before surgical repair [15]

Flowchart: Management steps	
Decision point	Recommended action
Asymptomatic, small pseudomeningocele	Observation, serial imaging
Symptomatic, mild/moderate, not enlarging	Conservative±EBP or lumbar drainage
Persisting symptoms, enlarging, large sac	Lumbar drainage, EBP, consider surgery
Failed conservative/interventional, infection	Surgical repair±excision, antibiotics
Recurrence or complication	Reassess, escalate intervention, long-term follow-up

resolving with conservative care or after drainage attempt [3].

• Percutaneous aspiration: Percutaneous aspiration of the CSF can be used as an adjunctive in select cases [17]. But the risk of infection and CSF fistula remain.

Step 5: Surgical management

Failed non-surgical measures or presence of complications

• Direct repair of dural defect with non-absorbable suture [3] (Fig. 3).

When conservative management fails, and symptoms develop, the optimal surgical treatment for pseudomeningoceles is direct closure of dural lesions with non-absorbable sutures. Non-absorbable sutures, such as 7-0 Prolene, provide a long-lasting, watertight closure that is necessary to prevent persistent CSF leaking [18]. According to studies, interrupted or running locked suturing procedures are equally effective at halting leaks [19]. This repair improves dural integrity, relieves symptoms like headaches and nerve root irritation, and lowers the risk of complications. Although adjuncts such as sealants may be utilized, research indicates that primary suture repair is still the most successful solo approach.

• Duraplasty if defect is large: Use autologous fascia, synthetic graft, or sealant [7].

• Duraplasty is recommended for large dural defects in pseudomeningocele cases where direct repair is inadequate. It entails grafting autologous fascia, synthetic dura augments, or sealants to close the defect. Autologous fascia, such as fascia lata, is recommended due to its biocompatibility and efficacy in restoring dural integrity [3]. Synthetic grafts can also be used depending on the extent of the defect and the patient's needs. Fibrin glue helps to create a watertight seal across suture lines, lowering the likelihood of postoperative CSF leakage. Surgicel helps by increasing clot formation and acting as a scaffold for fibrin deposition. Together, they work with sutured dural repairs in spine surgery to reduce bleeding, promote tissue adhesion, and aid in healing [20]. Duraplasty reduces CSF leaking, lowers recurrence risk, and promotes tissue repair in big dural holes.

• Excision of a large pseudomeningocele sac is warranted if they are symptomatic and large [3].

• Myofascial flap or tissue reinforcement as needed [7].

• Myofascial flap or tissue reinforcement is an important treatment for healing pseudomeningoceles, particularly in big or recurrent cases. This entails medial advancement of paraspinal musculofascial units to form a layered, "pants-on-vest" waterproof seal over the dural healing site. This approach eliminates dead space, promotes adhesion, and reduces CSF leakage. The pants-on-vest suture method provides a secure closure by overlaying tissue layers, which increases mechanical strength [21]. Myofascial flaps promote healing and reduce recurrence risk, and they are frequently paired with dural repair and lumbar subarachnoid drainage to provide the best results in symptomatic pseudomeningocele patients [7].

Step 6: Special considerations

• Infection: Antibiotics and surgical drainage. The management of pseudomeningocele involves antibiotic coverage tailored to infection risk, commonly intravenous antibiotics guided by culture and sensitivity, typically continued for about 7–14 days depending on clinical response. Acetazolamide is used to decrease CSF production and flow, usually administered at 250–500 mg intravenously every 8 h, with duration individualized based on patient response, often continuing until CSF leakage or intracranial pressure improves. Additional medications may include analgesics for symptom control and, in infectious cases, specific antimicrobials targeting identified pathogens [16].

• Giant pseudomeningocele: Combined surgical and CSF diversion approach [12]. Collections of CSF that are 8 cm in diameter or more are known as giant pseudomeningoceles [22].

They are an uncommon but significant side effect of spinal surgery that requires early intervention since they frequently manifest as pain, headache, nausea, or neurological abnormalities brought on by mass effect or nerve root entrapment. A mix of surgical procedures is used for management, such as lumbar subarachnoid drainage to lower CSF fluid pressure, correction of dural abnormalities, frequently with fascia grafts, and excision of the pseudomeningocele sac [5].

- Follow-up: Serial clinical assessment and imaging to track resolution or recurrence [16] (Table 1).

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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