Case report:

Title: Thoracolumbar Extradural Arachnoid Cysts: Report of Two Adult Cases

Running: Thoracolumbar Extradural Arachnoid Cysts

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Abstract

Background and Importance: Extradural spinal arachnoid cysts are a rare compressive pathology of the spinal cord. They are believed to arise from congenital defects in the dura mater, with gradual enlargement occurring over time. The mainstay of treatment for spinal extradural arachnoid cysts consists of closing the minute dural defect or ostia through which the arachnoid layer has subsequently herniated. Exposure and ligation of the fistula tract at the ostia can then be achieved by utilizing either multilevel or single level laminectomy.

Case Presentation: Two cases are presented herein that exhibited progressive weakness of the lower limbs. Magnetic resonance imaging in both patients displayed an extradural cystic mass at the thoracolumbar spine compatible with an extradural arachnoid cyst. In each case, following surgical excision of the arachnoid cyst, the corresponding ostia or tiny dural defect was securely closed with silk sutures. Postoperatively, neither patient reported any issues related to recovery during a six-month follow-up encounter.

Conclusion: Extradural arachnoid cysts are rare, benign, but potentially debilitating causes of spinal cord compressions. The mainstay of treatment is the closure of the dural defect or ostia. If the radiological localization of the ostia can be identified preoperatively, selective closure of the ostia using a minimally invasive surgical procedure is the intervention of choice. Otherwise,

closure of the dural defect will be possible following a multilevel laminectomy and total resection of the arachnoid cyst.

Key-words: Extradural arachnoid cyst, laminectomy, Paraparesis, Spinal arachnoid cyst, Thoracolumbar spine.

Highlights:

- Spinal arachnoid cysts are uncommon, accounting for about 1% of all primary benign spinal compressive pathologies.
- The pathogenesis of extradural arachnoid cysts involves herniation of the arachnoid layer into the extradural space through a tiny dural defect.
- Extradural arachnoid cysts may remain asymptomatic for a long period, and surgical intervention is indicated only in symptomatic cases.
- The mainstay of treatment for symptomatic cases remains the closure of the ostia with interrupted silk sutures or by using silver clips.
- The majority of patients undergoing surgery will experience sustained improvement in their neurological function, but long-term clinical and radiological follow-up will be mandatory.

Plain Language Summary:

Extradural spinal arachnoid cysts are a rare compressive pathology of the spinal cord. The mainstay of treatment for spinal extradural arachnoid cysts consists of closing the minute dural defect or ostia through which the arachnoid layer has subsequently herniated. Two presented cases exhibited progressive weakness of the lower limbs. Magnetic resonance imaging in both patients displayed an extradural cystic mass at the thoracolumbar spine, compatible with an extradural arachnoid cyst. In each case, following surgical excision of the arachnoid cyst, the corresponding ostia or tiny dural defect was securely closed with silk sutures. Postoperatively, neither patient reported any issues related to recovery during a ten-month follow-up encounter.

Background and Importance:

Spinal arachnoid cysts are uncommon, benign lesions that were first described by Spiller in 1903 [1-3]. These cysts are cerebrospinal fluid-containing masses lined by the arachnoid mater and account for about 1% of all primary spinal mass lesions. Spinal arachnoid cysts are most often located in extradural and intradural spaces while their intramedullary location is extremely rare[3-9.] Spinal extradural arachnoid cysts (EDAC) are thought to arise from a tiny defect in the dura mater, leading to subsequent herniation of the arachnoid layer into the extradural space and gradual enlargement over time [1-3,9].This pathology typically becomes symptomatic in the second to fourth decade of life and its discovery in older adults is much less frequent [1-3,9]. Before significant enlargement, an EDAC may remain asymptomatic for a long period. The mainstay of

surgery for symptomatic extradural arachnoid cysts is the closure of the fistula between the subarachnoid space and the cystic outgrowth [1-3,9]. Herein, we present two new symptomatic adult cases located at the thoracolumbar spinal level.

Cases Presentation:

Case 1: A 22-year-old woman presented with bilateral lower limb weakness and paresthesia for one year. Her symptoms had noticeably worsened within the last 2 months. Neurological examination demonstrated paraparesis with hyperactive reflexes and a positive Babinski sign**.** A sensory level with hypesthesia to pinprick and light touch was noted up to the umbilicus.

T1-weighted (A) and T2-weighted (B) sagittal magnetic resonance imaging (MRI) of the thoracolumbar spine revealed an extradural cystic lesion extending from the T11 to T12 levels. The cyst was hypointense on T1-weighted MRI and hyperintense on T2-weighted MRI, consistent with an extradural arachnoid cyst. The cyst displayed a compressive effect on the thinned, ventrally compressed cord in the axial views (Figure 1).

Following the performance of an appropriate 2-level laminectomy, an extra-dural cystic lesion was exposed. The cyst was meticulously dissected and separated from the dura until a left-sided ostia was discovered and closed utilizing silk sutures.

During a three-months follow-up encounter, the patient was able to ambulate with some difficulty, but by the 6-month mark, she could walk normally. In the control thoracolumbar MRI at the one-year follow-up encounter, the arachnoid cyst was no longer detectable (Figure 2).

Case 2: A 38-year-old man was admitted to the hospital for numbness and weakness in the left lower limb for two years, along with similar symptoms in the right lower limb for six months. The lower limb weakness had been exacerbated bilaterally in the last three months. His neurological examination revealed symmetric paraparesis with hyperactive reflexes and a bilateral Babinski sign.

In the sagittal thoracolumbar MRI, a large fluid-containing epidural mass extending from T11 to L1 was demonstrated. The cystic mass exhibited low signal intensity onT1 weighted images and high signal intensity on T2-weighted sagittal images, consistent with an extradural arachnoid cyst. In the axial images, the dural sac was significantly compressed by the arachnoid cyst (Figure 3). The computerized tomography scan also showed erosion of the T12 pedicle and scalloping of the L1 vertebral body (Figure 4). Following a three-level laminectomy, the transparent cyst was separated from the dura mater and completely excised (Figure5). Subsequently, the communicating dural fistula was visualized on the left side at the T12 level and was closed using a combination of silk sutures and silver clips.

The postoperative course was uneventful. At a six-month follow-up encounter, he was found to be doing very well with a normal neurological examination. His control MRI showed no signs of cord compression (Figure 6).

Discussion:

Spinal extradural arachnoid cysts are thin-walled, cerebrospinal fluid-containing masses lined by a layer of arachnoid [1-3]. The exact pathogenesis is still being debated. Yet herniation of the arachnoid layer into the extradural space through a tiny dural defect and its gradual enlargement

via a one-way valve mechanism is the most accepted among many likely scenarios. These cysts are commonly observed in patients aged 20 to 50 years, with a slight male predominance [1-3,9]. The cause of the tiny dural holes remains unclear, but it is widely believed to be congenital. The familial occurrence of extradural arachnoid cysts supports this theory [9-12]. Rarely, in a patient with EDAC, the primary dural hole may be secondary to closed, penetrating, or iatrogenic trauma and may develop as a result of arachnoiditis or post-hemorrhagic events [13-16].

Location and Numbers:

These lesions are predominantly located on the posterior aspect of the spinal cord and within the thoracic and thoracolumbar regions in about 77% of cases [1-3,13-16]. The lumbosacral and sacral regions, with a prevalence of 20%, are the next most frequent locations for the occurrence EDACs. Cervical spine EDACs, with an occurrence of 3%, are the rarest subtype [1-3,13-16]. In rare instances, spinal EDACs may be present in multiple spinal areas and display a slight predominance in females [9-12].

Clinical Picture:

The location and size of the cyst determines the specific symptoms and the severity of such symptoms [1-3,9-12,17-19]. The duration of symptoms is shorter in cysts that originate within the thoracic spine due to the smaller diameter of the spinal canal in this region [1-3,9-12,17-19]. The clinical manifestation of an EDAC depends on its size and location within the spinal column. This means that the symptoms in a cervical EDAC may vary from upper limb radicular pain or paresthesia to quadriparesis (1-3,9-12,17-19]. In contrast, thoracic examples typically present with symptoms that commence as intercostal pain or dysesthesia and ultimately result in spastic paraparesis. Lumbosacral EDACs most often emerge as radicular pain and weakness [1-3,9-12,17-19]. They may also manifest as urinary dysfunction [17-19]. On one rare occasion, a positive urinary Valsalva maneuver and intermittent priapism were reported in an extradural arachnoid cyst of the lumbar spine [20]. In patients who are either asymptomatic or present with mild symptoms, rapid deterioration can occur which may include the development of paraplegia and spontaneous posterior spinal cord herniation into the extradural space. In such cases, an arachnoid cyst should be suspected and ruled out [21].

Diagnosis:

Spinal extradural arachnoid cysts are best diagnosed based on their characteristic MRI findings. An EDAC exhibits characteristic signals identical to cerebrospinal fluid (CSF) on T1- and T2-weighted images. In addition to accurate diagnosis, delineation of the cystic dimensions can be calculated using MRI [1-3,9-12,17-19,21]. Several studies have employed specialized MR imaging techniques, such as cine-MRI and time-spatial labeling inversion pulse (T-SLIP) MRI, to locate the causative defect between the cyst and the subarachnoid space. [24,25]. This can be also detected with cine MRI by observing pulsating flow voids. [24,25] The location of the connection between the subarachnoid space and the cyst may also be suspected in an MR myelogram. [25] Digital subtraction cystography can be used to detect the communicating hole in EDAC. [26,27]

Treatment:

Treatment varies and depends on whether the patient is symptomatic. With the increasing use of magnetic resonance imaging (MRI), it is not unusual to find asymptomatic EDACs incidentally. In such cases, conservative treatment involving periodic clinical examination and evaluations of the cyst size with control MRI is recommended [1-3,16-19].

Laminectomy or laminoplasty, followed by excision of the cyst and subsequent closure of the ostia, has been the most popular approach to treatment [1-3,12-17-19]. It should be noted that the mainstay of surgery for symptomatic extradural arachnoid cysts is the closure of the communicating fistula between the subarachnoid space and the cyst [23-29]. Therefore, if the site of ostia can be identified preoperatively using cine MRI, MR myelogram, or CT myelography, selective closure of the communicating hole with focal laminectomy or minimally invasive surgery yields excellent results in terms of surgery duration and extent [23-27,29,30]. This approach also helps avoid spinal instability and malalignment associated with laminectomy [23-27,29,30]. However, it is important to remember that the preoperative identification of communicating ostia is very challenging. Consequently, if the communicating fistula is not discovered, decompressive laminectomy/laminoplasty, excision of the cyst and closure of the ostia will be the intervention of choice [1-3,31,32]. The exception would be children near puberty, in whom even multilevel laminoplasty might result in a late kyphotic deformity. In such cases, postponing surgery may be advisable.

It should be noted that in multiple arachnoid cysts, each cyst typically has its own ostia, therefore closure of all dural defects will be required during a surgical intervention.

Outcome:

Postoperatively, all patients with extradural arachnoid cysts will benefit from a decompressive laminectomy/laminoplasty, removal of the cyst, and closure of the ostia. However, with extensive laminectomy and even laminoplasty, the possibility of kyphotic deformity should be kept in mind. In such cases, periodic clinical examinations and radiological surveys are necessary. If spinal deformity appears, particularly in children and adolescents, appropriate temporary or permanent instrumentation for the correction of the deformity may become necessary.

Conclusion:

An EDAC can develop due to outpouchings or entrapment of the arachnoid membrane through a tiny dural defect resulting in gradual enlargement due to a ball-valve mechanism within the cystic opening. MRI is the diagnostic modality of choice, although computed tomography myelography may be superior in detecting the location of the tiny dural defect. Symptomatic arachnoid cysts should be treated surgically. Surgery aims to decompress the spinal cord or cauda equina and restore CSF flow dynamics with appropriate closure of the ostia. However, if the exact site of the fistula between the arachnoid space and EDAC is identified preoperatively, mini laminectomy and selective closure of the fistula at the ostia may then be considered the treatment of choice. Otherwise, laminectomy or laminoplasty, excision of the cyst, and closure of the communicating hole will remain the treatment of choice.

Ethical Consideration:

Compliance with ethical guidelines

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Sectors.

Authors' contribution

The authors equally contributed to writing the manuscript.

Conflict of interest

The authors declared no-conflicts of interest.

Figures:

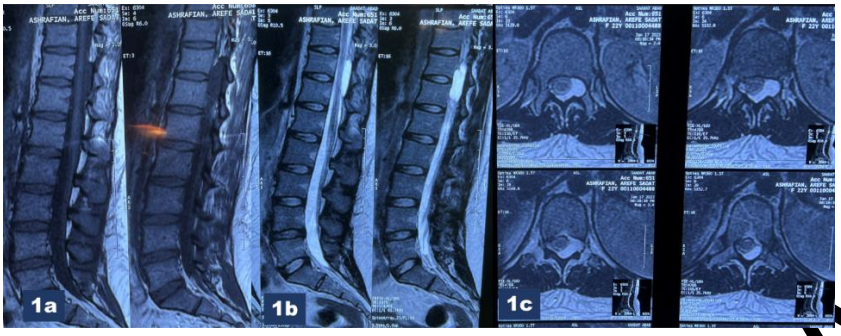

Figure 1: Thoracolumbar magnetic resonance imaging (MRI). (a) T1-weighted MR images show a hypointense mass at T11 and T12. (b) The mass is hyperintense on the T2-weighted image, compatible with cerebrospinal fluid or EDAC. (c) T2-weighted axial view; note significant compression of the spinal cord.

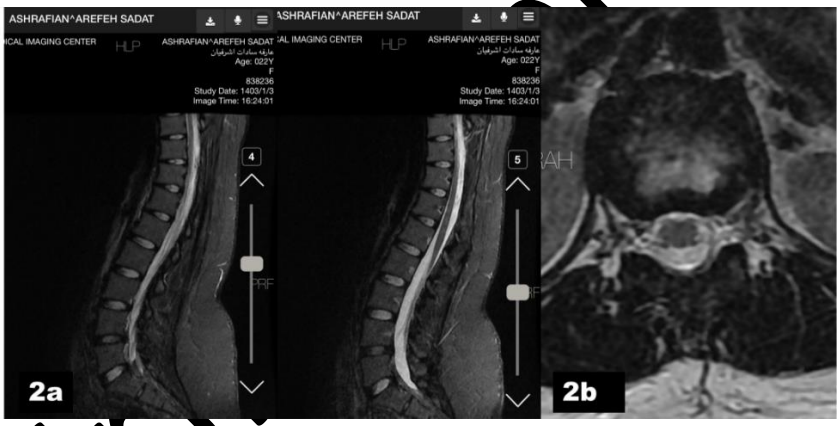

Figure 2: T2-weighted magnetic resonance imaging (MRI). (a) Sagittal images show thoracolumbar laminectomy and the canal is open. (b) T2-weighted axial image shows no compressive lesion remaining.

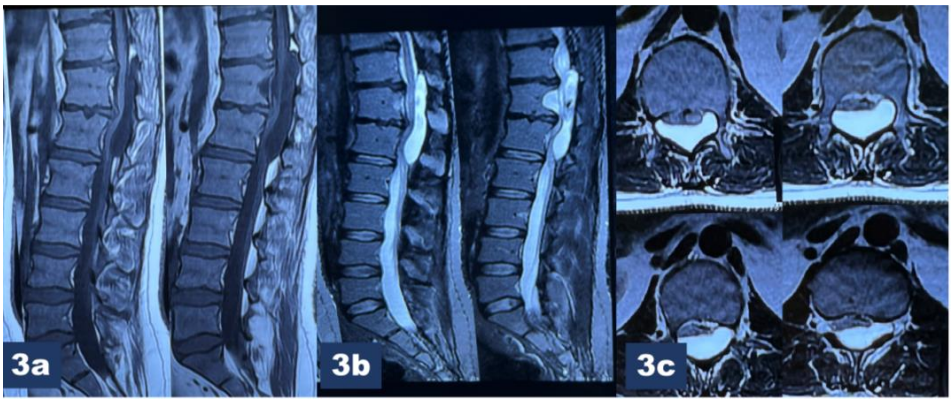

Figure 3: Thoracolumbar magnetic resonance imaging (MRI). (a) T1-weighted MR images show a hypointense mass extending from T11 to L1. (b) The mass is hyperintense in the T2-weighted images, compatible with cerebrospinal fluid or EDAC. (c) T2-weighted axial view; note significant cord compression.

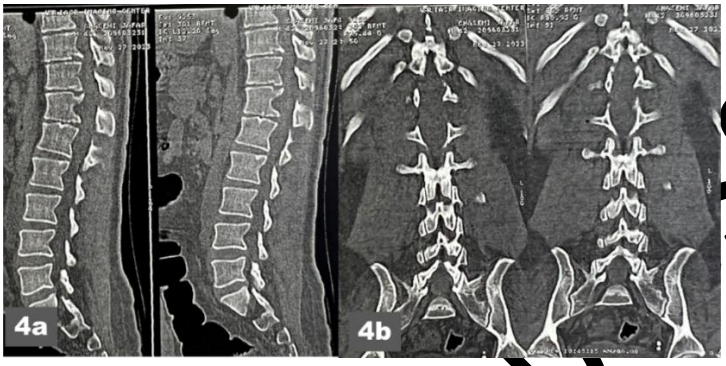

Figure 4: Reconstructed CT scan: (a) Notcalloping of the T12 vertebral body; (b) thinning of the T12 vertebral laminae is demonstrated.

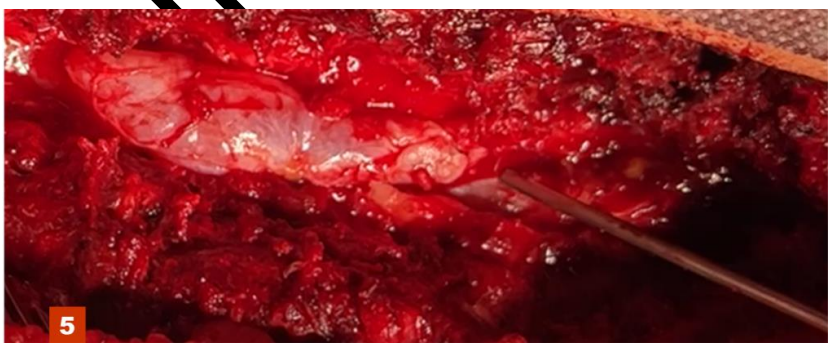

Figure 5: Surgical scene photograph; note the arachnoid cyst during dissection.

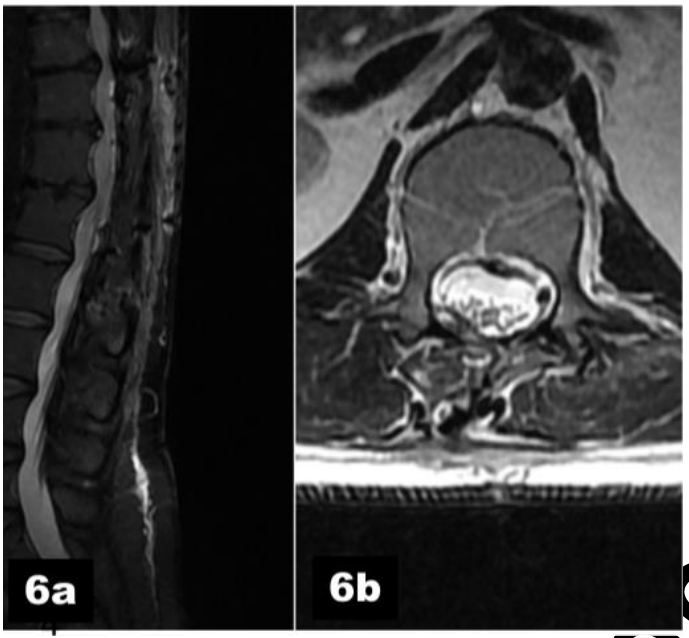

Figure 6: Thoracolumbar T2-weighted magnetic resonance imaging (MRI); (a) the sagittal image shows the patency of the vertebral canal; b) the axial view the demonstrates spinal cord expansion to its normal size at T12.

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