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Uncommon and Unbelievable; Extradural Spinal Arachnoid Cyst: A Rare Case Report and Systematic Review of the Literatures

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ABSTRACT

Introduction: Spinal arachnoid cysts are rare fluid-filled sacs that develop within the spine's protective layer, known as the arachnoid membrane. These cysts were first described by British neurologist George Spiller in 1903. The arachnoid cyst gets its name from the arachnoid membrane, one of the three layers of the meninges that surround and protect the brain and spinal cord. This membrane is responsible for producing cerebrospinal fluid, which acts as a cushion and shock absorber for the brain and spinal cord.

Case discussion: A 21-year-old female with no known medical conditions presented with a history of weakness and numbness in both lower limb for the past 1 years. Clinical examination and routine workup done with radiological investigation. An MRI of the spine showed a well-defined cystic lesion in the spinal canal measuring 22cm x 10.7cm x 8.2 cm, extending from the middle of the T11 to L3 vertebrae segment. After careful consideration, it was decided that surgery is necessary to relieve her symptoms and prevent further damage to her spinal cord.

Discussion: Spinal arachnoid cysts, although rare, are a fascinating and often misunderstood condition. Usually seen in patients between the ages of 30-50 years with a slight female predominance, their exact cause is still unknown. Diagnosis of spinal arachnoid cysts can be challenging, as the symptoms may mimic those of other spinal conditions. Treatment options for spinal arachnoid cysts depend on the severity of symptoms and the size and location of the cyst.

Conclusion: Spinal arachnoid cysts are rare but potentially debilitating conditions that can occur at any age and in any region of the spine. While their exact cause is unknown, advances in imaging technology have made it easier to diagnose and manage these cysts.

Keywords: Spinal arachnoid cyst, extradural arachnoid cyst, arachnoid cyst.

INTRODUCTION

Spinal arachnoid cysts, also known as spinal extradural arachnoid cysts, are rare fluid-filled sacs that develop within the spine's protective layer, known as the arachnoid membrane. These cysts were first described by British neurologist George Spiller in

1903, although the first reported case can be traced back to 1898 by German neurologist Max Nonne.

The arachnoid cyst gets its name from the arachnoid membrane, one of the three layers of the meninges that surround and protect the brain and spinal cord. This membrane is responsible for producing cerebrospinal fluid, which acts as a cushion and shock absorber for the brain and spinal cord. However, in some cases, this membrane can split or tear, leading to the formation of a cyst that fills with CSF. The exact reason for this splitting of the arachnoid membrane is still not fully understood. Some theories suggest that it could be due to developmental abnormalities in the womb or a result of trauma or infection. However, more research is needed to confirm these hypotheses.

Symptoms of spinal arachnoid cysts vary depending on the location and size of the cyst. In some cases, they may be asymptomatic and discovered incidentally during imaging tests for other conditions. However, when symptomatic, these cysts can cause compression on surrounding nerves and tissues, leading to neurological symptoms such as back pain, weakness or numbness in the limbs, difficulty with coordination and balance, and even bowel or bladder dysfunction. Diagnosis of spinal arachnoid cysts is typically made through imaging tests such as MRI or CT scans. These tests can accurately show the size, location, and extent of the cyst, allowing doctors to determine the best course of treatment. The standard treatment for symptomatic spinal arachnoid cysts is surgery. However, this decision is not taken lightly as surgical intervention comes with its own risks. Additionally, there is a lack of consensus among medical professionals about the most effective surgical approach for these cysts.

CASE REPORT

A 21-year-old female with no known medical conditions presented with a history of weakness and numbness in both lower limb for the past 1 years. She also experienced difficulty while walking due to weakness. The symptoms appeared gradually and without any specific cause such as injury, surgery, or infection. There was no involvement of the urinary or bowel systems. Upon examination, both lower limb had a power of 4/5 at hip and knee joint and 2/5 at bilateral ankle joint and bilateral EHL 0/5 with bilateral foot drop, reflexes was brisk with Babinski's reflex showing a downward response. On examination Sensation was reduced from T10 downwards. An MRI of the spine showed a well-defined cystic lesion in the spinal canal measuring 22cm x 10.7cm x 8.2 cm, extending from the middle of the T11 to L3 vertebrae segment. The lesion appeared dark on T1 images and bright on T2 images, causing compression in front of the spinal canal (see Figure 1). After careful consideration, it was decided that surgery is necessary to relieve her symptoms and prevent further damage to her spinal cord. On 21 January 2024 the patient underwent surgery to remove the cyst by performing T11 to L3 left partial laminectomy with excision of Arachnoid cyst under general anaesthesia. Intraop finding was T11 to L3 vertebrae lamina and spinous process was very thined out with severe cord compression by dorsally placed arachnoid cyst (see figure 2) The cystic membrane was successfully removed, resulting in a gradual return to normal spinal cord diameter and pulsation intraoperative. The patient recovered without complications and regained full neurological function in her lower limb by the third day after surgery with power of 5/5 at hip, knee, and ankle, foot drop also recovered. A biopsy of the removed tissue was sent and report came as cyst wall lined by flattened to cuboidal epithelial cells. Cyst wall also shows fibrosis, small congested blood vessels with psammomatous calcification concluded as Arachnoid cyst. On follow-up appointments, she reported being able to walk without difficulty or weakness in her limbs. Now she is able to walk without assistance and reported a significant improvement in her quality of life after surgery.

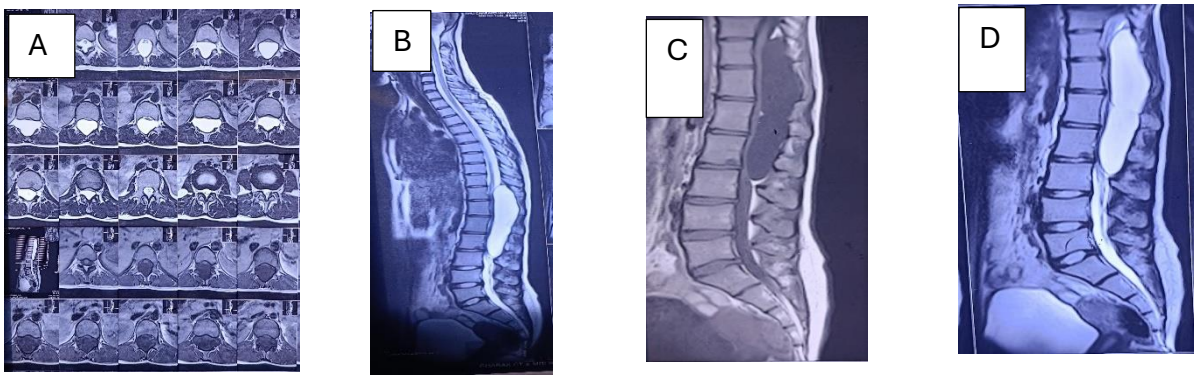

Figure 1. MRI of spine showing Extradural Arachnoid cyst (A), extending from T11 to L3 vertebrae level with severe cord compression (B), with T1 hypointense (C), and T2 hyperintense (D).

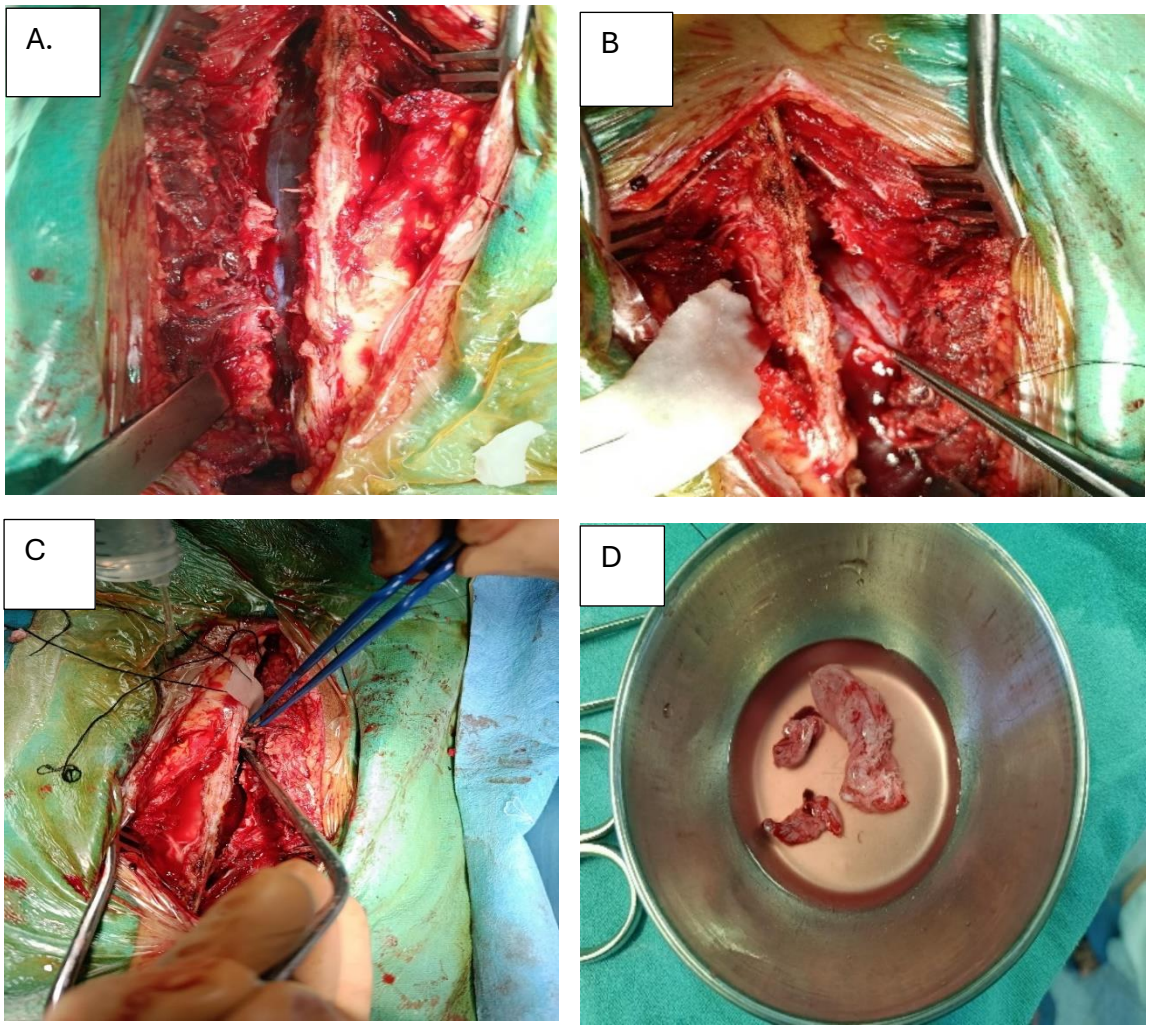

Figure 2. Showing Intra-op Extradural Arachnoid cyst (A) with removal technique (B) and post removal normal cord (C) with cyst membrane specimen (D).

DISCUSSION

Spinal arachnoid cysts, although rare, are a fascinating and often misunderstood condition. These cysts are filled with cerebrospinal fluid and can occur in various locations along the spine, most commonly in the mid-thoracic and thoracolumbar regions. While they are usually seen in patients between the ages of 30-50 years with a slight female predominance, their exact cause is still unknown. Spinal arachnoid cysts are most commonly solitary lesions and occur

most frequently in the thoracic spine (located in the middle of the back), followed by the lumbar (lower back) and lumbosacral (lower back and sacrum) regions. They can also occur in the cervical (neck) and sacral (tailbone) regions, but these cases are less common.

These cysts can develop either dorsal (towards the back) or ventral (towards the front) to the spinal cord, with dorsal being more common. Thoracic extradural cysts are typically found in adolescents, while lumbar and sacral cysts tend to occur in adults. They have been reported in all age groups, with a slight preponderance in females. The precise cause and mechanism of development for spinal arachnoid cysts remains uncertain. Some theories suggest that they may be congenital (present at birth), traumatic, or inflammatory in nature. It is also thought that abnormal pulsations of cerebrospinal fluid (CSF) may play a role in their formation, as well as an osmotic gradient between the subarachnoid space (the space between the arachnoid and pia mater layers of the meninges) and the cyst. Additionally, a one-way valve-like mechanism between the cyst and dural sac (the covering of the spinal cord) may contribute to the enlargement of the cyst.

Symptoms of spinal arachnoid cysts vary depending on the level of compression on the spinal cord or nerve roots. Some individuals may experience back pain, while others may experience leg weakness, numbness or tingling, and difficulty with bladder or bowel control. These symptoms can come and go, with periods of remission and exacerbation.

Diagnosis of spinal arachnoid cysts can be challenging, as the symptoms may mimic those of other spinal conditions. Plain X-rays may show signs of a possible space-occupying lesion in the spine, but a definitive diagnosis requires further imaging. Computed tomography (CT) myelography is a useful tool for visualizing the compressed spinal cord and the displacement of nerve roots. It is also essential in identifying any communication between the cyst and the subarachnoid space. Magnetic resonance imaging (MRI) can also be used to confirm the diagnosis, as it shows a non-enhancing extramedullary loculated cyst with a similar appearance to CSF.

Treatment options for spinal arachnoid cysts depend on the severity of symptoms and the size and location of the cyst. In some cases, conservative management with pain medication and physical therapy may be sufficient to manage symptoms. In more severe cases, surgery may be necessary to decompress the spinal cord and remove or drain the cyst.

CONCLUSION

Spinal arachnoid cysts are rare but potentially debilitating conditions that can occur at any age and in any region of the spine. While their exact cause is unknown, advances in imaging technology have made it easier to diagnose and manage these cysts. If you are experiencing symptoms such as back pain, leg weakness, or numbness, it is essential to seek medical attention for an accurate diagnosis and appropriate treatment plan. With proper management, individuals with spinal arachnoid cysts can go on to live fulfilling lives with minimal impact on their spinal health.

LITERATURE REVIEW

Author/ year	Demographics	Clinical features	Cyst location	Surgical treatment	Outcomes
Funao et al. 2012,	Mean Age 39.7 years Age range 22-60 years M: F 7:5	Numbness 7(58%), Back pain 3(21%), LL weakness 2(14%) Gait disturbance1(7%); Sphincter problems1(7%), Muscle atrophy 1(7%)	All Thoraco lumbar All extradural	Total resection of cyst 7- complete laminectomy Closure of dural defect without cyst resection	Neurological improvement in all post-op No recurrence Poor outcomes in 4 patients with symptom duration >1yr and cyst >5 vertebrae
Oh et al. (2012)	Mean Age 34.8 years Age range 12-77 years M: F 5:9	Lower limb weakness 11(79%) Radicular pain 9(65%), Back pain 9(65%) Para paresis 10(71%) Mono paresis 1(7%)	Thoraco lumbar 11 Lumbar 2, Thoracic 1 All extradural All dorsal All idiopathic	Laminotomy in all cases; Dural defect found in 13 cases (93%) in axilla of nerve root 6 laminoplasty, 8 laminectomy Complete cyst excsion/marsupialisation of wall and closure of dural defect	Odom's Criteria and Prolo functional economic outcome rating scale 12 Excellent, 1 good, 1 fair Prolo score increased from pre-op 6.8 to post-op 9.2 ($p<0.01$)
Tokmak et al (2015)	Mean age 43.3 years Age range18-67 years M: F 4:6	Back pain 8(80%) Radicular pain 5(50%) Weakness5(50%), sensory changes 5(50%) Para paresis 5(50%), Monoparesis1(10%) Sensorydeficits7(70%)	8 Thoracic 2Thoracolumbar All extradural	Laminectomy 2, hemilaminectomy 3 and laminoplasty 4 Total excision 6 cases Partial excision, closure of dural defect 3 1 case of CSF fistula repaired intraoperatively	Motor functions improved in all patients Pain, numbness and sphincter disturbance remained in some
Mohindra et al (2010)	Mean age 25 years Age range 6 to 46 years	All patients had symptoms and signs of myelopathy	3 Thoracic 4 Cervical 2 Sacral 1Lumbar All intradural	Laminectomy for dorsally placed cysts	The patients improved clinically to near normal status in all cases
Wang et al (2003)	Mean age 46 years Age range 17-80 years M: F 13:8	Neuropathic pain 20(95%), Myelopathy11(53%), Sphincter problems5(24%)	Thoracic 3 Cervicothoracic 1 Thoracolumbar 1 Lumbosacral All intradural, idiopathic	Laminectomy and radical cyst wall resection	Cyst resolution in 19 cases All 7 syrinx decreased in size, 4 completely resolved Weakess improved in 100%
Klekamp et al (2017)	Mean age 51.9 years Age range 7 to 81 years M: F 6:7	Pain (69%), Hyposthesia (55%), Dysesthesia (41%) Motor weakness (45%), Gait ataxia (69%), Sphincter problems (27%)	122 Thoracic 7 Lumbar, 1 Cervical Intradural	Cysts extending less than 3 segments-laminectomy to expose cyst Cysts extending more than 3 segments-resection of the upper pole of the cyst was performed Duroplasty in all patients where possible	Postop patients with idiopathic arachnoid cysts showed improved scores for all symptoms (pain, hypesthesia, dysesthesia,

					motor weakness, gait and sphincter function)
Viswanathan et al (2017)	Mean age 52.1 years Age range 35-68 years M: F 9:5	Gait issues 14(100%) Sensory12(86%), Weakness11(79%), sphincter complaints 4(29%), long tract signs10(71%)	12Thoracic 1 Cervicothoracic 1Thoracolumbar All intradural	Laminectomy, cyst fenestration and partial wall resection	Outcome measure- mJOA Stable or improved at 6 weeks follow-up Complete or partial syrinx resolution 7/8 cases
French et al (2017)	Mean age 60 years Age range 20-77 years M: F 3:7	Gait issues Myelopathy 9(90%) Sensory 6(60%), Radicular pain 3 (30%), Weakness 3(30%) Sphincter problems 2(20%), Pain1 (10%).	10 Thoracic (100%) All dorsal All intradural, idiopathic	Laminectomy; Cyst excision 4 (40%), fenestration 6 (60%) Dural patch for repair of dural defect 1 (10%)	Significant clinical improvement 7 (70%); no change 3 (30%), Sphincter complaints resolved 2 (100%) Complete resolution of radiculopathy 1; Gait ataxia improved in 6 (67%)
Moses et al (2018)	Mean age 55.1 years Age range 19-78 years M: F 12:9	Weakness 14(67%), Sensory14(67% Pain12(57%) Gait issues 11(52%), Sphincter problems 5(24%)	15 Thoracic 4 Cervicothoarcic 2 Lumbosacral All intradural	Laminectomy 18, laminoplasty 3 Duroplasty 8	Weakness improved in 10 patients (74%), resolution of some sensory symptoms (64%) Improvement in bowel/bladder disturbance (64%), reduced postoperative pain (50%) Gait improved (55%)
Kalsi et al (2022)	Mean age 47.8 years Age range:18 to 73 M: F 8:3	Neuropathic pain6(55%), Backpain5(45%), Weakness5(45%), Gait problems 5(45%), Balance issues 5(45%), 4 (36%), Sphincter problems 2(18%), Radicularsymptoms1(9%),	10 Thoracic,1 Cervicothoracic All intradural	MIS 2, Laminoplasty 2, Laminectomy 7, Cyst excision/ marsupialised 7, fenestration 3 partial excision 1 8 expansile duroplasty, 3 primary dural clsoure 1 cystoperitoneal shunt	No objective outcome measures 3 patients asymptomatic 7 patients improved compared with pre-op 1 patient improved and then developed numbness in the lower extremeties

Declaration by Authors

Ethical Approval: This study was conducted after getting approval from institute Ethical Committee board. And consent has been taken with patient for publication of her data and images.

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Conflict of Interest: No conflicts of interest declared.

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