Spinal Intradural Arachnoid Webs Causing Spinal Cord Compression with Inconclusive Preoperative Imaging: A Report of 3 Cases and a Review of the Literature

Dafang Zhang and Efstathios Papavassiliou

OBJECTIVE: **Spinal arachnoid webs are a rare variant of spinal arachnoid cysts where 1 or multiple focal membranes of arachnoid tissue obstruct the subarachnoid space. Only 11 prior cases of arachnoid webs have been reported in the literature. We present a series of 3 consecutive cases of arachnoid webs from our institution and review the literature on this rare condition to provide recommendations for its management.**

METHODS: **Retrospective chart review was performed for 3 consecutive cases of intradural arachnoid webs causing spinal cord compression at our institution, with inconclusive preoperative imaging, treatment with surgical decompression, and resection. There were no external sources of funding.**

RESULTS: **Our cases occurred dorsally in the thoracic spine and were associated with syringomyelia. Preoperative magnetic resonance imaging, computed tomography myelography, and cine magnetic resonance imaging were inconclusive, and the definitive diagnosis was made with intraoperative ultrasound. Patients underwent laminectomies and resection of arachnoid webs. Unique from prior reports of arachnoid webs, the webs in the present cases were composed of multiple septated longitudinal membranes rather than a transverse band. All patients had improvement of presenting symptoms postoperatively.**

CONCLUSIONS: **Intradural arachnoid webs causing spinal cord compression are rare. Preoperative imaging may be inconclusive. Because of the septated longitudinal nature of the visualized membranes, we propose a 1-way valve mechanism of cerebrospinal fluid obstruction causing gradual cord compression and resultant syringomyelia.**

INTRODUCTION

Spinal arachnoid cysts are rare intradural pockets of cerebrospinal fluid (CSF) that may grow to cause cord compression. Approximately 80% of spinal arachnoid cysts occur in the thoracic spine, and 33% are associated with syringomyelia[1]; although most are dorsal to the cord, ventral arachnoid cysts have been reported.[2-4] When symptomatic, arachnoid cysts manifest with symptoms of pain, weakness, numbness, gait ataxia, or incontinence.[1,5,6] Numerous surgical options have been proposed for arachnoid cysts, including marsupialization, fenestration, and cyst wall resection.[1,5-8]

Arachnoid webs are a rare variant of arachnoid cysts in which 1 or multiple focal membranes of arachnoid tissue obstruct the subarachnoid space. Only a few cases of arachnoid webs have been reported in the literature.[9-12] Most arachnoid webs are associated with syringomyelia, the precise mechanism of which is controversial. We present a series of 3 consecutive cases of arachnoid webs from our institution. All cases occurred dorsally in the thoracic spine and were associated with syringomyelia. Unique from prior reports of arachnoid webs, the webs in all cases were composed of multiple septated longitudinal membranes, rather than a transverse band, as confirmed by intraoperative ultrasound. Moreover, all 3 cases had multiple radiologic studies, which were all read as inconclusive for any lesions by neuroradiologists.

Key words
- Arachnoid cyst
- Arachnoid web
- CSF flow dynamics
- Decompression
- Spinal cord compression
- Syringomyelia

Abbreviations and Acronyms
CSF: Cerebrospinal fluid
CT: Computed tomography
MRI: Magnetic resonance imaging

Department of Orthopaedic Surgery, Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA

To whom correspondence should be addressed: Dafang Zhang, M.D. [E-mail: dzhang9@partners.org]

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In addition, the radiologists were concerned for anterior cord herniation secondary to an anterior dural defect, as described in the literature.[13,14] As is typical of arachnoid webs, a definitive diagnosis was elusive on preoperative imaging and confirmed only on intraoperative ultrasound.

MATERIALS AND METHODS

Our study was exempt from institutional review board adjudication per institutional policy regarding small case series. We performed a literature search of PubMed for arachnoid webs with no limitations on language or date of publication. The initial search for arachnoid webs revealed 11 results. We excluded results pertaining to idiopathic syringomyelia and arachnoiditis without a definitive diagnosis of arachnoid webs. Precise searches revealed 4 results pertaining to spinal arachnoid webs.[9-12] All results were read by the authors.

CASE SERIES

Case 1

History and Examination. A 45-year-old man presented to the spine center for an outpatient neurosurgical consultation because of symptoms of upper thoracic back pain for 6 months. The pain was burning and stabbing in quality and worse in a seated position. He was previously treated with chiropractic care with no relief. He denied bowel or bladder dysfunction, saddle anesthesia, or other neurologic symptoms. He denied fevers, night sweats, weight loss, or other bone pain. He denied a history of trauma or spine surgery. On examination, the patient had no tenderness to palpation of the spinous processes. He exhibited full strength in both upper and lower extremities and an unremarkable sensory examination. Reflexes were normal and symmetric bilaterally. Gait was normal.

Imaging Studies. Magnetic resonance imaging (MRI) of the thoracic spine showed a syrinx at the level of T2-3. Immediately inferior to the syrinx, the cord appeared flattened and anteriorly displaced, and the caliber of the cord abruptly decreased (Figure 1A). These findings were corroborated by computed tomography (CT) myelography, on which no filling defects were observed to suggest the presence of an arachnoid cyst or ventral cord herniation (Figure 1B). Sagittal cine MRI CSF flow studies of the thoracic spine were obtained to rule out an arachnoid cyst or a transverse arachnoid band causing obstruction of CSF flow. On MRI CSF flow studies, active CSF pulsations were seen at the level of the cord compression, excluding a loculated cyst (Figure 1C). Despite negative preoperative imaging findings, posterior thoracic arachnoid webs were suspected based on the flattened and ventrally displaced appearance of the cord on sagittal MRI. Radiologists were concerned for a dural defect and anterior cord herniation.

Surgical Treatment. The patient was brought to the operating room for T2-3 laminectomies and exploration of the intradural space. After the lamina and spinous processes were removed, intraoperative ultrasound was used over the dura mater to identify the spinal cord clearly displaced anteriorly, multiple longitudinal septations posteriorly, and the known syrinx superior to the area of compression (Figure 1D and E). A midline durotomy was made, and multiple thick, nebulous, indistinct membranes at the area of compression were seen to connect the dura mater to the underlying cord. No arachnoid cyst was visualized. The membranes were resected, and the cord immediately re-expanded.

Postoperative Course. The patient was seen for a wound check and a follow-up examination at 6 weeks, at which point his pain was much improved. He no longer experienced pain in a seated position, and he was no longer using narcotic pain medications. His neurologic examination was unremarkable. Repeat MRI of the thoracic spine at 1 month after surgery showed interval decrease in the size of the syrinx (Figure 1F). At 6 months after surgery, the patient remained pain-free and had returned to full activities.

Case 2

History and Examination. A 69-year-old woman presented to the emergency department with bilateral lower extremity numbness for 3 weeks and new bowel incontinence for 4 days. Numbness extended from the saddle distribution to her buttocks and down to the heels of both feet. She complained of occasional shooting pain in the same distribution as well as "tripping over her feet" during this time. Her past medical history was significant for a right-sided petrosal sinus dural arteriovenous fistula managed with aspirin, monoclonal gammopathy of undetermined significance, mixed connective tissue disease, and diabetes. She denied a history of spine surgery, but she reported a minor motor vehicle accident 2 years prior after which she had a short period of low back pain. On examination, the patient had no tenderness to palpation of her spinous processes. She exhibited full strength in both upper and lower extremities. Sphincter tone was diminished. Her sensation was intact to light touch, but she reported subjectively diminished sensation in both lower extremities. Perianal sensation was intact. Reflexes were normal and symmetric bilaterally. Gait was ataxic.

Imaging Studies. MRI of the thoracic spine showed a syrinx at the level of T2-3. Immediately inferior to the syrinx, the cord appeared flattened and anteriorly displaced. Degenerative changes were seen throughout the thoracic spine with a notable posterior disc protrusion at T3-4 (Figure 2A). These findings were corroborated by CT myelography (Figure 2B). No filling defects were observed on CT myelography to suggest the presence of an arachnoid cyst or ventral cord herniation. Sagittal cine MRI CSF flow studies of the thoracic spine were obtained, on which active CSF pulsations were seen anterior and posterior to the spinal cord at the level of the cord compression, excluding a loculated cyst (Figure 2C and D). Despite negative preoperative imaging findings, posterior thoracic arachnoid webs were suspected based on the flattened and ventrally displaced appearance of the cord on sagittal MRI.

Surgical Treatment. The patient was brought to the operating room for T2-3 and partial T4 laminectomies and exploration. After the lamina and spinous processes were removed, intraoperative ultrasound was performed over the dura mater to identify the spinal cord clearly displaced anteriorly, multiple longitudinal septations posteriorly, and the known syrinx superior to the area of compression (Figure 2E and F). CSF pulsations were visualized