Spinal Arachnoid Webs: Presentation, Natural History, and Outcomes in 38 Patients

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BACKGROUND: Spinal arachnoid webs are rarely described bands of thickened arachnoid tissue in the dorsal thoracic spine. Much is unknown regarding their origins, risk factors, natural history, and outcomes.

OBJECTIVE: To present the single largest case series, detailing presenting symptoms and outcomes amongst operative and nonoperative patients, to better understand the role of intervention.

METHODS: This retrospective chart review identified 38 patients with arachnoid webs. Patient demographics, radiologic signs, symptoms, and surgical history data were extracted from the electronic medical record. Symptoms were divided by location and character. 28 patients were successfully contacted for follow up outcome surveys.

RESULTS: 26 patients (68%) underwent surgical intervention, 12 (32%) were managed non-operatively. 15 (39%) patients had undergone a previous unsuccessful surgery at a different site for their symptoms prior to arachnoid web diagnosis. Commonly presenting symptoms included myelopathy (68%), focal thoracic back pain (68%), lower extremity weakness (45%), numbness and sensory changes (58%), and lower extremity radicular pain (42%), upper extremity weakness (24%), and radicular pain (37%). Focal thoracic pain was associated with thoracic level ($P < .02$). Myelopathic symptoms were less common in postoperative patients. Postoperative patients described significantly more upper extremity ($P < .01$) and thoracic ($P < .01$) numbness and paresthesias. Surveyed nonoperative patients universally described their symptoms as either stable or worsening.

CONCLUSION: Spinal arachnoid webs present with thoracic myelopathy and back pain but can also present with upper extremity symptoms. Surgical intervention stabilizes or improves symptoms and is well received. Nonoperative patients do not spontaneously improve.

KEY WORDS: Arachnoid web, Myelopathy, Spine

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Spinal arachnoid webs are rarely described bands of thickened arachnoid tissue in the subarachnoid space of the dorsal thoracic spine and are thought to produce clinical symptoms by exerting a belt-like mass effect on the spinal cord.[1,2] They are distinct from arachnoid cysts because of their lack of distinct separation from the rest of the subarachnoid space, with no evidence of delayed filling on computed tomography (CT) myelography.[1] They are identified by the characteristic "scalpel sign" on magnetic resonance imaging (MRI) (Figure 1) and CT myelography.[1,3] As less than 50 of these have been reported in the literature—often as case reports[2-8]—their cause remains largely unknown. Given these rare descriptions, much remains unclear regarding their origin, risk factors, natural history, and surgical outcomes. Even commonly presenting symptoms, including weakness, radiculopathy, upper motor neuron findings, myelopathy, and paresthesias, remain poorly understood.

To further understanding of this rare entity, we present the single largest case series of spinal arachnoid webs; a total of 38 patients evaluated identified across several hospitals at our single institution between 2012 and 2020. Included are several radiographically identified patients who did not undergo surgical intervention, providing greater insight into the natural history of the disease. Our hope is that this work will provide greater understanding of the clinical

FIGURE 1. *Impact of surgical intervention on a spinal arachnoid web seen with T2 MR imaging.* **A**, *Preoperative thoracic arachnoid web with associated scalpel sign, syrinx, and T2 cord signal change.* **B**, *1-d post-laminectomy and resection demonstrating release of scalpel sign.* **C**, *7 mo postoperative with resolution of T2 signal change and syrinx.*

presentation, surgical vs nonsurgical decision-making, and outcomes of this unique pathology.

METHODS

Eligibility Criteria

A retrospective chart review was performed across multiple hospitals within a single healthcare system. This study was approved by our Institutional Review Board for imaging and patient records without need for additional consent, as well as follow up outcome surveys with patient consent (IRB Study no. STUDY0000332). Patients had the right to withdraw their data from the study at any time. Potential cases were also identified via search of Neurosurgery faculty surgical case series for the inclusion criteria of "arachnoid web," "web," or "arachnoid cyst." Additional cases were derived from our radiologic database by a similar search.

Study Screening and Selection

T2-weighted MRI)and CT myelogram when available—was reviewed for each patient resulting in 46 potential cases for evaluation. Arachnoid Webs were identified by the pathognomonic "scalpel sign" by a single reviewer, and when available confirmed via operative report, resulting in 38 positively identified patients (Figure 2).

Data Abstraction

Patient demographics, radiologic signs, symptoms, and surgical history were extracted from the electronic medical record. These data were entered into a separate database for analysis. Recorded factors, if available, included patient name, hospital, age at time of diagnosis, MRI date, myelogram date, level of radiographic abnormality, surgery date, operation performed, presenting symptoms, duration of symptoms, and previous surgeries. MR and CT imaging was reviewed findings associated with the arachnoid web. Data were converted into numerical format and combined into multiple data sheets, alongside such factors as age, age at diagnosis, sex, dates of imaging, date of diagnosis, presence of scalpel sign, presence of a syrinx, presence of T2 hyperintense spinal cord signal change, surgery date and operation performed, subjective symptoms, duration of symptoms prior to diagnosis, neurological symptoms, prior injuries/trauma, comorbidities, and preceding operations.

Outcomes

A total of 28 patients (74%) were successfully contacted via phone for follow up surveys and agreed to participate in the study. Subjective measures of neurologic symptoms and symptom progression were obtained for both surgical and nonsurgical patients. Follow-up surveys were tabulated into data sheets regarding survey date, current neurologic symptoms, current age, and subjective outcomes.

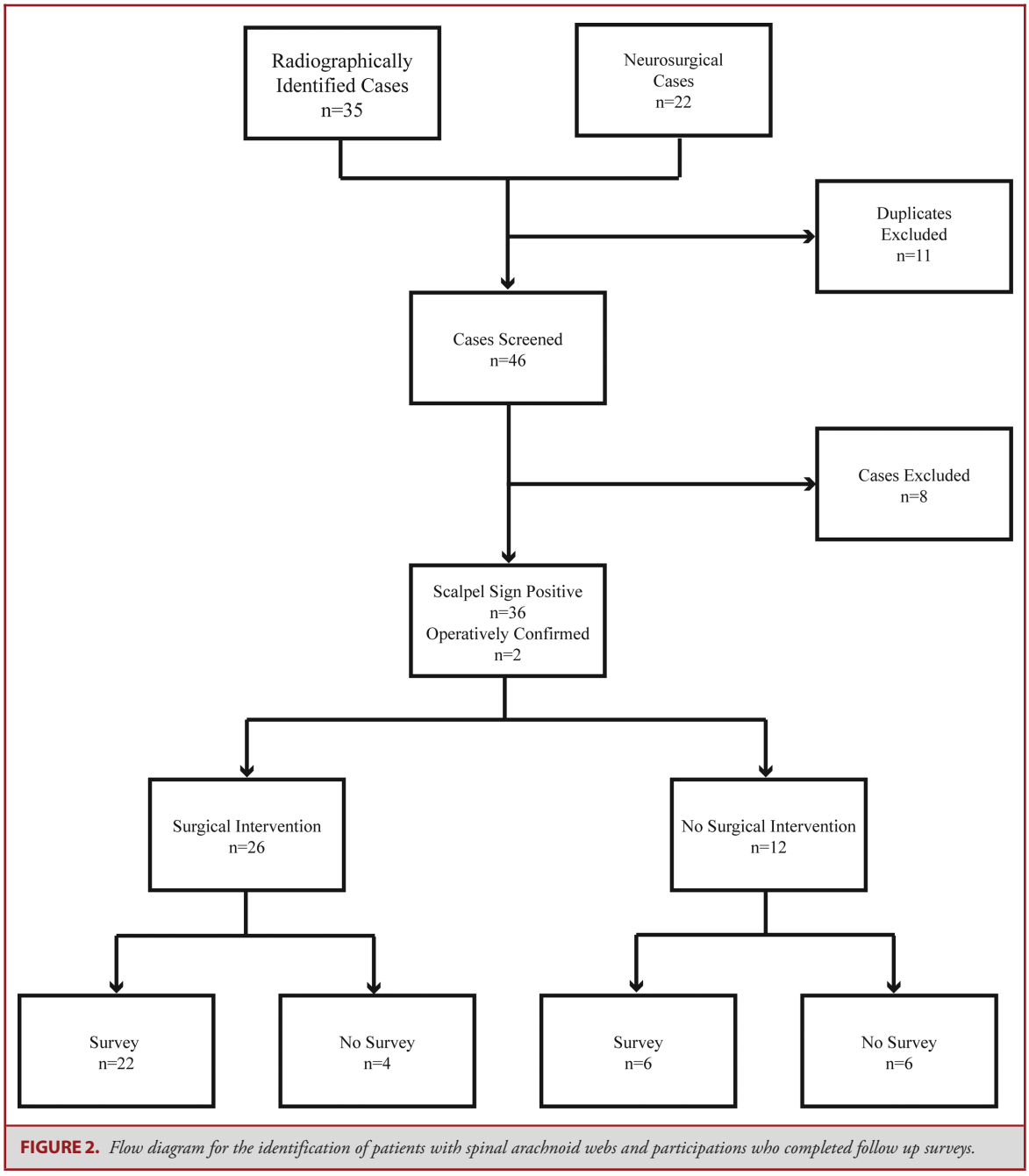


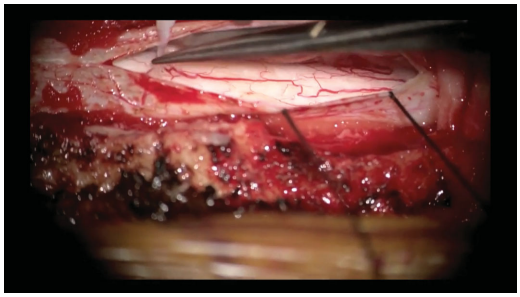
FIGURE 2. *Flow diagram for the identification of patients with spinal arachnoid webs and participations who completed follow up surveys.*

Statistical Analysis

Data sheets were imported into MATLAB 2020b (The MathWorks, Natick, Massachusetts) for figure generation and analysis. Presenting symptoms and imaging findings were evaluated against thoracic level with linear correlation. Additional evaluation of correlation between imaging findings and presenting symptoms, as well as outcomes, was performed using Fisher's exact test. For all statistics, alpha was taken as <0.05 for significance.

RESULTS

A total of 46 cases were reviewed, of which 38 cases were identified as spinal arachnoid webs based on radiographic or surgical criteria (Figure 2). 26 of these (68%) underwent surgical intervention, with all surgical patients undergoing a laminectomy and resection of the web, 1 patient undergoing a concurrent cervical fusion, and 1 who received a thoracic syrinx shunt.



VIDEO. *Resection of arachnoid web with accompanying intraoperative ultrasound.*

TABLE 1. Patient Demographics

	All patients (%)	Surgical	Nonsurgical
No. of Patients	38	26	12
Male	14 (37)	9 (35)	5 (42)
Female	24 (63)	17 (65)	7 (58)
Clinical management		26 (68)	12 (32)
Age at diagnosis (yr)			
Mean	55	55	56
Range	25-76	25-76	31-76
Imaging modalities			
MRI	38 (100)	26 (100)	12 (100)
CT Myelogram	14 (37)	12 (46)	2 (17)
Imaging findings			
Scalpel sign	36 (95)	24 (92)	12 (100)
Syrinx	12 (32)	10 (38)	2 (17)
Cord signal change	20 (53)	14 (54)	6 (50)
Duration of symptoms prior to diagnosis (yr)			
Mean	4.6	4.5	4.5
Range	0-30	0.04-13	0-30
Previous surgery	15 (39)	11 (42)	4 (33)
Previous traumatic CNS Injury	3 (8)	2 (8)	1 (8)
Surgical intervention			
Laminectomy/resection	26	26	
Shunt	1	1	
Cervical fusion	1	1	

An example of the operative technique, as well as the intraoperative ultrasound findings, can be seen in the accompanying video (Video). The remaining 12 (32%) patients were managed nonoperatively. Nonoperative patients either chose to not pursue surgery or were not referred for neurosurgical management. Surgical intervention was not statistically correlated with presenting symptoms, T2-hyperintensity, or the presence of a syrinx. 24 patients (63%) were female and 14 (37%) were male, with females undergoing more frequent surgical intervention (Table 1). The mean age at diagnosis across all patients was 55 (range 25-76), and on average patients described 4.6 yr of symptoms (range 0-30 yr) prior to diagnosis. 15 (39%) patients had undergone a previous unsuccessful spine surgery at a different level for their symptoms prior to diagnosis. 14 (37%) patients received a CT myelogram, many to clarify the diagnosis, whereas all patients received an MRI reviewed by a fellowship trained neuroradiologist. On MR imaging, 12 patients (32%) had an associated syrinx, and 20 (53%) demonstrated T2 cord signal change. Presence of a syrinx or T2 cord signal change was not statistically correlated with the thoracic level of the arachnoid web. 36 (95%) patients demonstrated a clear scalpel sign on MRI. Two patients did not have a clear scalpel sign but were intraoperatively confirmed as arachnoid webs upon direct visualization. Only 3 (8%) patients described a previous traumatic central nervous system injury prior to symptom onset. 5 (13%) patients described prior trauma, and none endorsed previous infection or meningitis. 11 (31%) were diagnosed with diabetes mellitus type 2, 8 (21%) smoked cigarettes, and 30 (81%) were overweight (body mass index > 25).

All spinal arachnoid webs were identified between levels T2 and T8, with the majority found between levels T4 and T7 (Figure 3). No significant association was noted between the level of the arachnoid web and surgical intervention. Symptoms were divided into pain, sensory, motor, and upper motor neuron signs, and further subdivided by upper extremity, thoracic, and lower extremity symptoms, for comprehensive evaluation (Table 2). No significant differences were noted in the presenting symptoms of patients who underwent surgical intervention compared with those who pursued nonsurgical intervention, nor was there an association with such imaging findings as a syrinx or T2 cord signal change and surgical intervention. The most common presenting symptoms were myelopathic in nature (coordination, balance, and walking difficulty) (26 cases, 68%) and focal thoracic back pain near the site of the arachnoid web (26, 68%) (Table 3). Patients also commonly described lower extremity symptoms, including weakness (17, 45%), numbness and sensory changes (22, 58%), and radiating lower extremity radicular pain (16, 42%). Imbalance (22, 58%) and hyperreflexia (19, 50%) were also commonly identified. Despite the thoracic location of all arachnoid webs, patients also described upper extremity symptoms, including upper extremity weakness (9, 24%), numbness and sensory changes (7, 18%), and radiating radicular pain (14, 37%).

Whereas most symptoms did not statistically correlate with thoracic level (Figure 4), focal thoracic pain was the exception. More superiorly located arachnoid webs were more likely to present with focal thoracic pain, less so with more inferiorly located webs ($P < .02$). Similar trends were noted for upper extremity symptoms—including upper extremity weakness, radiculopathy, and sensory symptoms (Figure 4A)—however, these trends did not reach statistical significance.

At the time of this analysis, 26 patients had undergone surgical intervention. We compared the symptoms of these patients with the 12 patients who had not undergone surgical intervention (Table 4). Several patients demonstrated dramatic improvement

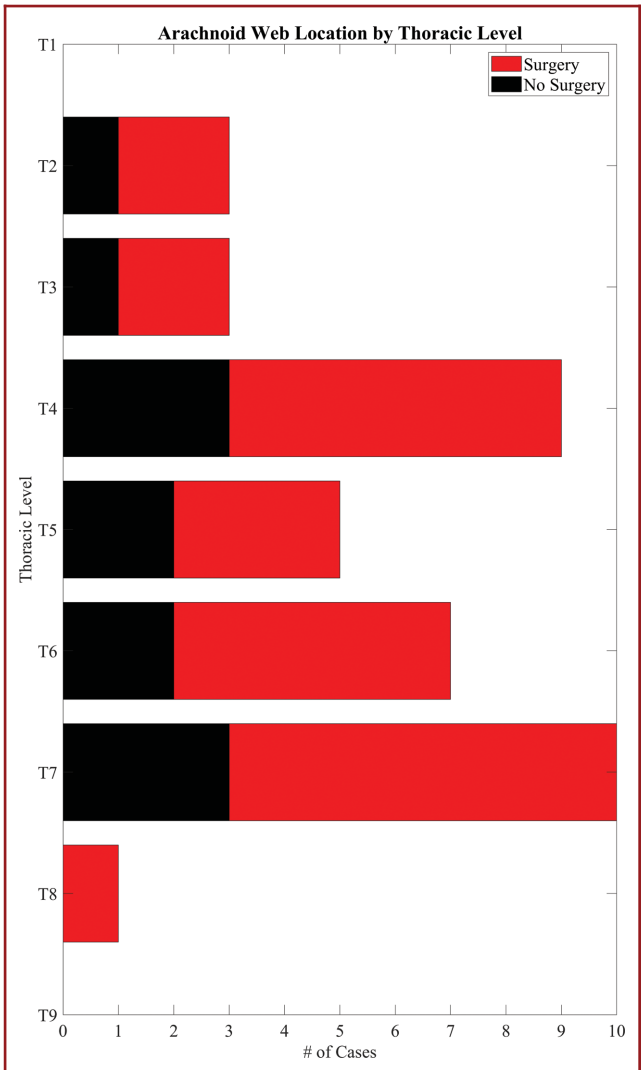


FIGURE 3. *Spinal arachnoid web location by thoracic level. No significant correlation between arachnoid web level and surgical intervention.*

in preoperative radiographic abnormalities, with resolution of syrinxes and cord signal abnormalities (Figure 1). Myelopathic symptoms diminished in frequency postoperatively (Figure 5), although this trend did not reach statistical significance. Focal thoracic pain was largely unchanged in both the surgical and non-surgical population. Postoperative patients described significantly more upper extremity ($P < .01$) and thoracic ($P < .01$) numbness and paresthesias after surgical intervention. No significant changes in symptoms were noted in the nonoperative population from their initial evaluation, and all those surveyed described their symptoms as either stable or worsening. In contrast, many of the postsurgical patients noted their symptoms were stable to improved, and 19 (86%) of the 22 postsurgical patients interviewed responded that they would have undergone surgical intervention again given their current outcome. No significant long-term complications were noted in the surgical group.

DISCUSSION

This study nearly doubles the number of known cases of arachnoid webs cases in the literature, and is the first to describe the nonoperative natural history. Several factors enabled identification of this large population. Our tertiary care center has a large referral base, and our neuroradiologists are highly adept at identifying arachnoid webs. Furthermore, all patients at our center who present with a cervical syrinx are screened for arachnoid webs. Although there could be a population factor that predisposes our cohort to spinal arachnoid webs, given the frequency of missed diagnosis, we believe this to be an entity that is likely underrecognized.

In comparison to a recent literature review our population demonstrated more female patients (63% female here vs 72% male in the review) and a lower rate of syringomyelia (32% here vs 67%).[2] It is unclear whether this is a true difference or simply variation secondary to rare description. We similarly noted that webs were exclusively found in the thoracic spine; most commonly between T4 and T7.

The origin of arachnoid webs remains elusive. Only 3 (8%) of our cases described a previous traumatic injury, consistent with the literature,[2] and suggesting against development secondary to trauma. They may instead be a variant of intradural arachnoid cysts, or remnants of the arachnoidal septum posticum—a thin membrane that separates the posterior spinal subarachnoid space and dorsal spinal cord.[1,2,9,10] Another theory suggests a congenital or inflammatory process leading to a thickened ligamentum flavum.[11]

The mechanisms by which symptomatology is generated are also unclear. The web appears to redirect the normal flow of the cerebrospinal fluid (CSF) into the spinal cord, producing microtrauma with each pulsation (Video).[5] This could manifest as edema within the cord, suggested by the T2 hyperintensity in 53% of our cases. It may also produce syringomyelia—identified in two-thirds of patients in the literature[1,2,11] and seen in 32% of our patients. The T2 hyperintensity within the cord may represent a "presyrinx" state that progresses to syringomyelia.[12,13] Syrinx formation could instead be secondary to altered CSF flow producing a negative pressure Venturi effect within the canal relative to the cord.[1,11,14]

It seems clear that the source of patient's symptoms is often missed at initial evaluation. The average duration of symptoms prior to diagnosis was 4.6 yr, during which repetitive cervical or lumbar imaging failed to identify the pathology. And although most (95%) demonstrated a scalpel sign, it was not always appreciated. Furthermore, 15 (39%) patients had undergone a prior surgery for their symptoms at a different level during this period, potentially unnecessarily, as they often noted a lack of

TABLE 2. All Patient's Symptoms at Presentation

			Radiographic findings			Pain			Sensory			Motor		Upper motor neuron				
Patient	Age at diagnosis	Sex	Thoracic Level	Syrinx	T2 cord signal	Focal	UR	LR	UE	Thoracic	LE	UW	LW	Myelopathy	Imbalance	Hyperreflexia	Incontinence	Surgery
1	57	F	4	N	N	Y	N	Y	Y	N	N	Y	N	Y	N	Y	N	Y
2	55	F	4	N	N	Y	Y	N	N	N	N	Y	N	Y	N	Y	N	N
3	63	M	3	N	N	Y	N	N	N	N	Y	N	Y	N	N	N	Y	N
4	36	F	5	N	N	Y	N	N	N	Y	N	N	N	N	N	Y	Y	Y
5	64	F	5	N	N	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	N	N
6	76	F	6	N	Y	N	N	N	N	N	Y	N	N	N	N	N	N	N
7	51	F	6	N	Y	N	N	N	N	Y	Y	N	Y	Y	Y	Y	N	Y
8	51	M	6	Y	Y	Y	Y	Y	N	N	Y	N	Y	Y	Y	Y	Y	Y
9	65	F	5	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N
10	48	F	4	Y	Y	N	Y	Y	Y	N	Y	N	N	Y	Y	Y	N	N
11	66	F	8	N	Y	N	N	Y	N	N	Y	N	N	Y	Y	Y	Y	Y
12	58	M	7	Y	Y	N	N	N	N	N	Y	N	Y	Y	Y	N	Y	Y
13	55	M	7	N	Y	Y	N	Y	N	N	Y	N	Y	Y	Y	Y	N	Y
14	31	M	6	Y	Y	Y	N	Y	N	N	Y	N	Y	Y	Y	Y	N	Y
15	43	M	7	Y	Y	N	Y	N	Y	Y	N	N	N	N	N	N	N	N
16	63	F	6	N	N	Y	Y	Y	N	Y	N	Y	Y	Y	Y	N	Y	Y
17	64	M	6	N	N	N	N	N	N	N	Y	N	Y	N	N	N	N	Y
18	71	F	4	N	N	Y	N	Y	N	N	N	N	N	N	Y	N	N	Y
19	60	F	7	Y	N	Y	Y	N	N	Y	N	Y	N	N	Y	N	N	Y
20	67	M	3	N	N	Y	N	Y	N	N	Y	N	Y	Y	N	Y	N	Y
21	56	F	4	N	Y	Y	N	N	Y	N	Y	N	N	Y	Y	Y	Y	Y
22	31	M	6	N	N	N	N	N	N	N	Y	N	Y	N	N	N	N	N
23	56	F	2	Y	Y	Y	Y	N	Y	N	N	Y	N	Y	Y	Y	N	Y
24	33	F	7	Y	Y	N	N	N	N	N	Y	N	N	Y	Y	N	Y	Y
25	61	M	3	Y	Y	Y	N	Y	N	N	N	N	Y	Y	Y	Y	N	Y
26	68	M	2	N	Y	Y	Y	N	N	N	N	Y	Y	Y	Y	N	N	N
27	53	F	5	N	Y	Y	N	N	N	Y	N	N	N	N	N	N	N	Y
28	58	F	7	N	N	N	N	N	N	N	Y	N	Y	Y	Y	N	N	Y
29	65	F	4	N	N	Y	N	Y	N	N	Y	N	N	Y	Y	Y	N	Y
30	62	M	5	Y	Y	Y	N	N	Y	Y	N	N	N	N	N	N	N	Y
31	68	F	4	N	N	Y	Y	Y	N	N	Y	N	N	N	N	N	N	N
32	66	F	7	N	N	Y	N	N	N	N	Y	N	Y	Y	N	Y	N	Y
33	53	M	2	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	N	Y
34	53	F	4	N	N	Y	Y	Y	N	N	Y	N	Y	Y	Y	Y	N	Y
35	59	F	7	N	N	N	N	N	N	N	Y	N	Y	Y	N	N	Y	Y
36	36	F	7	N	N	Y	Y	Y	N	Y	N	N	N	Y	Y	N	N	N
37	25	F	4	Y	Y	Y	Y	Y	N	N	N	Y	N	Y	N	N	N	Y
38	59	M	7	N	Y	Y	N	N	N	N	Y	N	Y	Y	Y	Y	N	Y

UR = upper radicular; LR = lower radicular; UE = upper extremity; LE = lower extremity; UW = upper weakness; LW = lower weakness.

TABLE 3. Presenting Symptoms

Symptom	All patients	Nonsurgical presentation	Presurgical presentation	*P* value
Upper extremity weakness	9 (24)	3 (25)	6 (23)	1.00
Upper extremity sensory	7 (18)	2 (17)	5 (19)	1.00
Upper radicular pain	14 (37)	7 (58)	7 (27)	.08
Thoracic sensory	10 (26)	3 (25)	7 (27)	1.00
Focal thoracic pain	26 (68)	7 (58)	19 (73)	.46
Lower extremity weakness	17 (45)	4 (33)	13 (50)	.49
Lower extremity sensory	22 (58)	7 (58)	15 (58)	1.00
Lower radicular pain	16 (42)	4 (33)	12 (46)	.50
Myelopathy	26 (68)	6 (50)	20 (77)	.14
Imbalance	22 (58)	5 (42)	17 (65)	.29
Hyperreflexia	19 (50)	4 (33)	15 (58)	.30
Incontinence	9 (24)	1 (8)	8 (31)	.22

improvement. Although the most frequently reported symptoms were focal thoracic back pain, lower extremity symptoms, and thoracic myelopathy, 24% also described upper extremity weakness, 18% upper extremity numbness, and 37% upper extremity radicular pain, potentially confounding localization. Although the mechanisms underlying these upper extremity symptoms are unclear, they tended to be more associated with upper thoracic webs. It is possible that the changes in CSF flow that produce these symptoms acts along the spinal cord significantly more proximally than the site of the pathology, generating false localizing signs without correlating radiographic abnormalities.

Diagnosis, therefore, must rest on clinical suspicion and a careful history and physical. Our study suggests spinal arachnoid webs may be more common than previously believed, given the frequency, but are likely not so common that the benefit of extensive workup at initial presentation outweighs the costs. The scalpel sign served as an effective marker for arachnoid webs and CT myelograms an effective adjunct. Treatment consisted of focal laminectomy and resection of the adhesive arachnoid tissue and was well received by patients, 86% of which described satisfaction with their surgical outcomes. Intraoperative ultrasound can help identify the level of the web and reveals the altered CSF flow dynamics (Video). Importantly for patient counseling, surgical intervention did not significantly alter focal thoracic pain, and was statistically significantly associated with increased upper extremity and thoracic sensory numbness or paresthesia. Although the mechanism underlying this increase remains unclear, it may be related to an underrecognition of upper extremity symptoms during initial evaluation. Prospective studies that specifically address pre- and postoperative symptoms will better distinguish if this is truly postsurgical or instead a postoperative recognition of a preoperative symptom.

Patients did not worsen postintervention, with a nonsignificant trend towards decrease in myelopathy. Subjectively most patients described a decrease in symptom severity, consistent with previous reports.[2] In a dramatic case, one patient presented with acute paraplegia and now describes full strength and range of motion. The population of patients who underwent surgical intervention did not significantly differ from those who did not, suggesting that symptomatology was not correlated with the need for or benefit to intervention. No patients who decided against surgical intervention described spontaneous improvement. Given these results, we recommend surgical intervention in cases of symptomatic arachnoid webs, with the understanding that intervention will likely prevent the worsening of myelopathy but may not improve such presenting symptoms as focal thoracic back pain.

Limitations

This study was limited by its retrospective nature. Although every attempt was made to standardize and assess the information from the medical record, many patients were evaluated prior to common knowledge of spinal arachnoid webs within our institution, and may have been limited in their initial evaluation. It is possible that some symptoms went unappreciated pre-operatively. Those that were treated more recently may still be recovering from surgical intervention—long-term outcomes are pending. The small sample size limits our findings and the conclusions that can be drawn. We have provided the data from each patient in the hopes that they be incorporated into future meta-analyses. We specifically included patients who had not undergone surgical intervention to better characterize the natural history of this disease. Although we did not find any statistical associations that would indicate why some patients underwent surgery whereas others did not, it is possible that an unclear and uncharacterized bias exists. This remains a relatively unknown population and will warrant further investigation. Future work would benefit from more standardized prospective symptom evaluation, taking advantage of validated symptom scales and doing so in a multiinstitutional fashion.

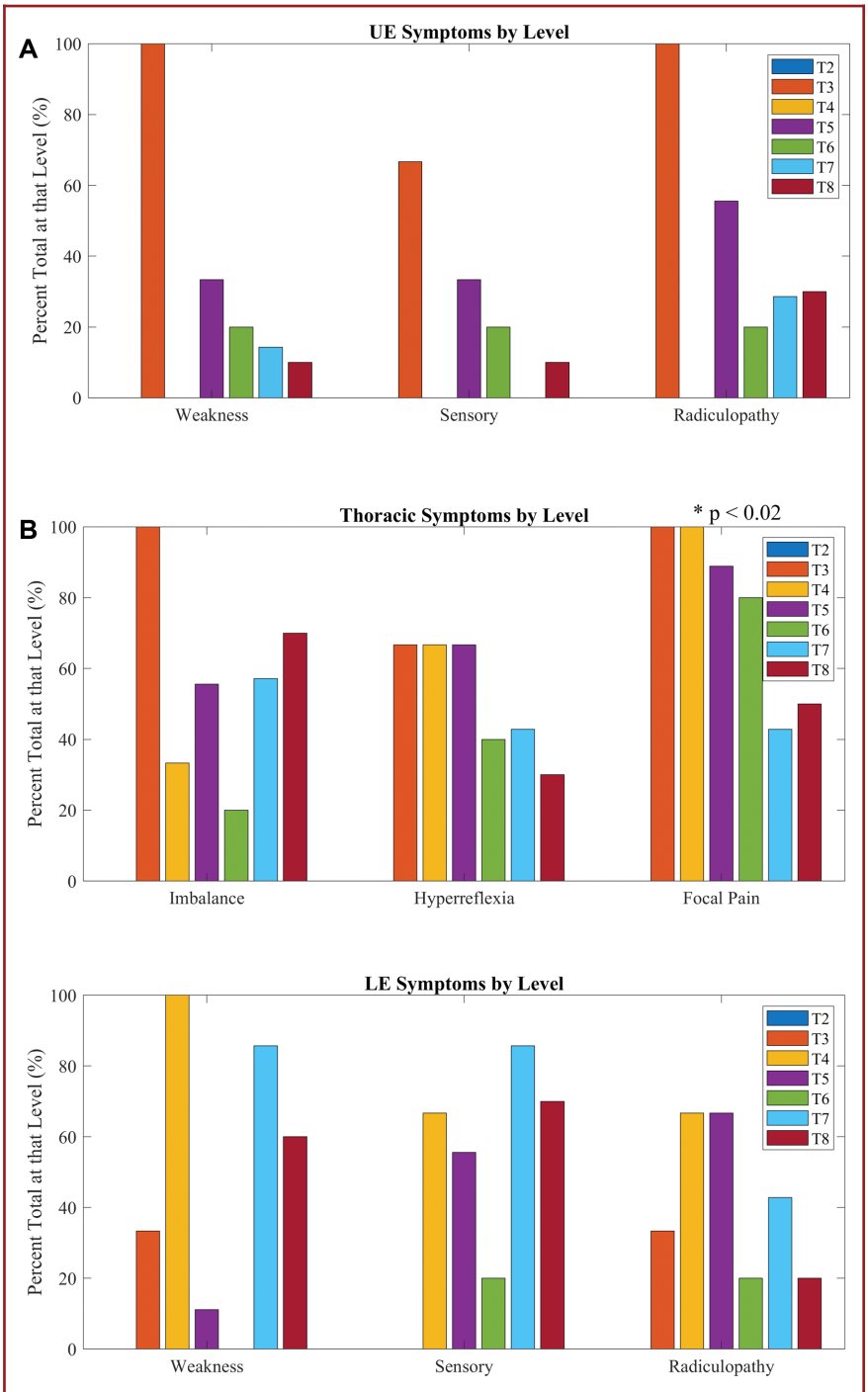


FIGURE 4. *Percent of patients with an arachnoid web at that level demonstrating the associated symptom.* **A**, *Note the decreasing frequency in upper extremity symptoms with increasingly caudal web.* **B**, *Focal thoracic pain was statistically significantly associated with arachnoid web level (*, $P < .02$). Myelopathic and lower extremity symptoms were regularly distributed across the population without relationship with the level of the web.*

TABLE 4. Surveyed Patient's Symptoms at Follow-Up

Patient	Age at diagnosis	Months at follow-up from diagnosis or Surgery	Sex	Radiographic findings			Pain			Sensory			Motor		Upper motor neuron				Surgery
				Thoracic level	Syrinx	T2 cord signal	Focal	UR	LR	UE	Thoracic	LE	UW	LW	Myelopathy	Imbalance	Hyperreflexia[a]	Incontinence	
1	57	95.8	F	4	N	N	N	N	N	Y	N	N	N	N	N	N		N	Y
2	55	29.9	F	4	N	N	Y	N	Y	N	N	Y	N	Y	N	N		Y	N
3	63		M	3	N	N													N
4	36		F	5	N	N													Y
5	64	32.2	F	5	N	N	Y	N	N	N	N	N	Y	N	N	N		N	N
6	76	30.5	F	6	N	Y	Y	N	N	Y	Y	Y	N	Y	N	N		N	N
7	51	10.6	F	6	N	Y	Y	N	N	N	N	N	Y	Y	Y	Y		N	Y
8	51	20.4	M	6	Y	Y	Y	N	Y	N	N	Y	N	Y	N	Y		N	Y
9	65		F	5	N	Y													N
10	48	26.6	F	4	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y		Y	N
11	66	10.1	F	8	N	Y	Y	N	N	N	N	Y	N	Y	N	N		N	Y
12	58	29.7	M	7	Y	Y	Y	N	N	N	N	Y	N	Y	Y	Y		Y	Y
13	55	13.6	M	7	N	Y	Y	N	N	N	N	N	N	N	N	N		N	Y
14	31	21.1	M	6	Y	Y	Y	N	N	N	N	Y	N	Y	Y	Y		N	Y
15	43		M	7	Y	Y													N
16	63		F	6	N	N													Y
17	64	42.6	M	6	N	N	N	N	N	N	N	N	N	N	N	N		N	Y
18	71	22.2	F	4	N	N	Y	Y	N	Y	N	Y	Y	Y	Y	Y		Y	Y
19	60	7.7	F	7	Y	N	Y	N	N	N	Y	N	N	N	Y	N		Y	Y
20	67	11.4	M	3	N	N	Y	N	N	N	N	Y	N	N	Y	Y		N	Y
21	56	20.2	F	4	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y
22	31		M	6	N	N													N
23	56		F	2	Y	Y													Y
24	33	8.7	F	7	Y	Y	N	N	N	N	N	Y	N	Y	N	N		Y	Y
25	61	35.1	M	3	Y	Y	Y	N		N	N	Y	N	Y	N	N			Y
26	68		M	2	N	Y													N
27	53	37.1	F	5	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		N	Y
28	58		F	7	N	N													Y
29	65	69.1	F	4	N	N	Y	N	N	N	Y	N	N	N	N	N			Y
30	62	11.2	M	5	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	N		N	Y
31	68	9.1	F	4	N	N	Y	N	Y	N	Y	Y	N	N	N	N		N	N
32	66	12.2	F	7	N	N	N	N	N	N	Y	Y	N	N	N	N		N	Y
33	53	29.4	M	2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		N	Y
34	53		F	4	N	N													Y
35	59	2.4	F	7	N	N	Y	Y	Y	Y	N	Y	N	Y	Y	Y		N	Y
36	36	104.5	F	7	N	N	Y	N	Y	N	N	Y	N	Y	N	N		N	N
37	25	5.4	F	4	Y	Y	Y	Y	N	Y	N	N	Y	Y	Y	N		N	Y
38	59	3.3	M	7	N	Y	Y	N	Y	N	N	N	N	Y	Y	Y		N	Y

UR = upper radicular; LR = lower radicular; UE = upper extremity; LE = lower extremity; UW = upper weakness; LW = lower weakness.
[a]Interviews were conducted over the phone and therefore are subjective in nature. Hyperreflexia was unable to be assessed in this fashion.

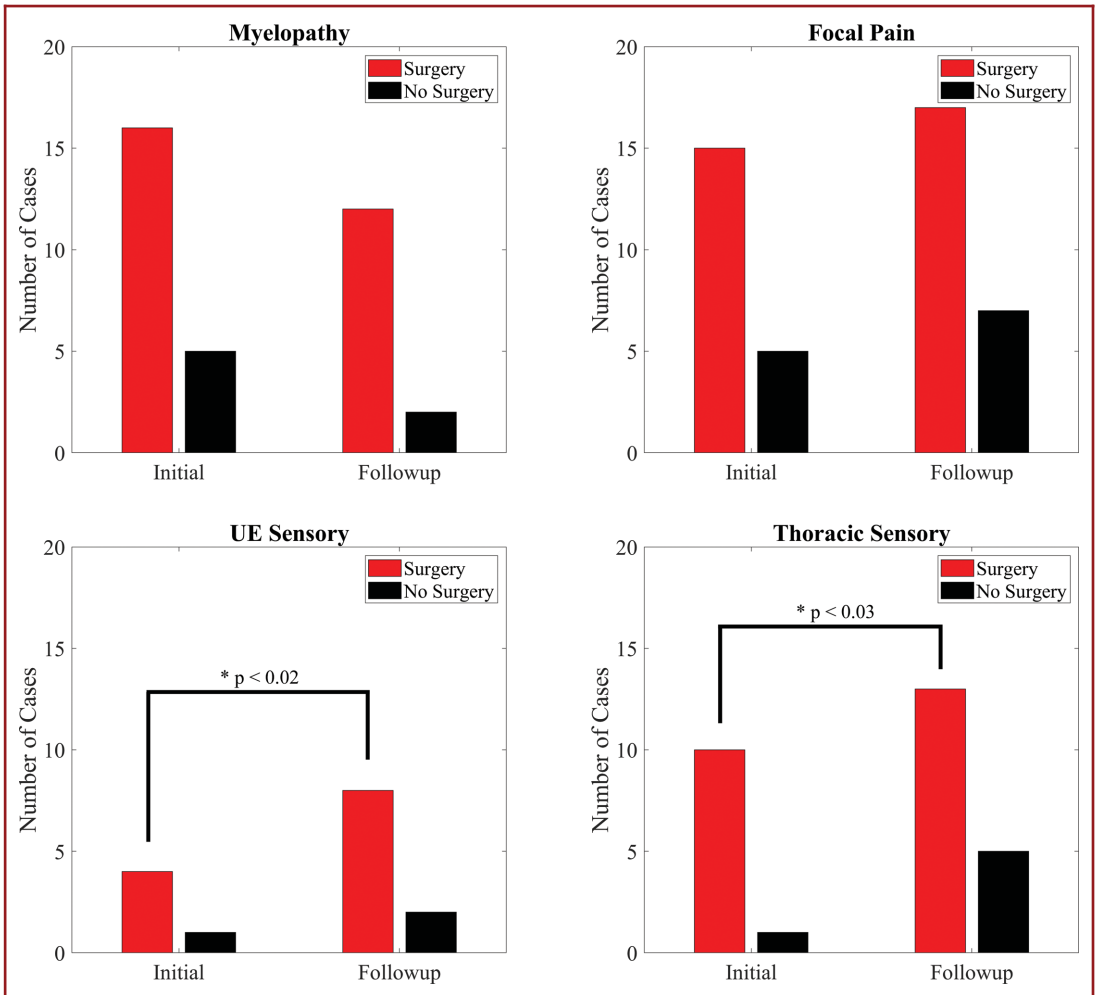


FIGURE 5. *Comparison of surgical and nonsurgical outcomes. Postoperatively patients described less frequent myelopathy, and subjectively endorses improvement in symptoms; however, this trend was not statistically significant. Focal pain continued to be present regardless of surgical intervention. Upper extremity sensory symptoms (numbness and paresthesias), and thoracic sensory symptoms were more common in patients who underwent surgical intervention (∗, P < .02 and P < .03, respectively).*

CONCLUSION

Spinal arachnoid webs are rarely described bands of thickened arachnoid tissue found in the thoracic spine. They most commonly present with focal pain and symptoms of thoracic myelopathy, but up to 37% of our patients described upper extremity symptoms. The "scalpel sign" was highly associated with the pathology. Surgical intervention subjectively improved myelopathic symptoms and was well received by patients during outcome evaluations. In contrast, nonoperative management resulted in the stability or worsening of symptoms. Surgical intervention did not alter focal thoracic back pain, and our evidence suggests patients may experience new thoracic sensory symptoms secondary to surgery. Given the favorable outcomes (86% satisfaction) in patients undergoing surgical intervention, we recommend it be offered to cases of symptomatic arachnoid webs.

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