CASE REPORT

Dorsal Thoracic Arachnoidal Web: A Rare Case Report

Dorsal Torasik Araknoidal Web: Nadir Bir Olgu Sunumu

Adil Aytaç Bahar Yanık Keyik Erdoğan Bülbül

Balıkesir University, Faculty of Medicine, Department of Radiology, Balıkesir, Türkiye.

DOI:10.38175/phnx.1543230

Cite as:
Aytaç A, Yanık Keyik B, Bülbül E. Dorsal Thoracic Arachnoidal Web: A Rare Case Report. Phnx Med J. 2025;7(1):21-23.

Correspondence:
Adil Aytaç, Balıkesir University Faculty of Medicine, Department of Radiology, Balıkesir, Türkiye.

E mail: dradilaytac@gmail.com

Received: 03 Eylül 2024
Accepted: 04 Mart 2025
Online Published: 10 Mart 2025

ABSTRACT
Arachnoid webs are intradural, extramedullary, fibrous connective tissue bands located, originating from the pial surfaces within the subarachnoid space. Patients may present asymptomatically or with symptomatic conditions associated with cord compression and disturbances in cerebrospinal fluid flow dynamics. Although arachnoid webs themselves are often indistinguishable via imaging modalities, the presence of the highly specific yet non-pathognomonic "scalpel sign" is crucial for diagnosing this entity. Magnetic resonance imaging is the most useful modality for diagnosis. This case report presents the clinical and radiological findings of a 39-year-old patient diagnosed with the rare entity of thoracic arachnoid web.
Keywords: *Scalpel sign, Magnetic Resonance Imaging, Arachnoid Web*

ÖZET
Araknoidal web'ler, subaraknoid boşlukta bulunan ve pial yüzeylerden kaynaklanan intradural ekstramedüller yerleşimli fibröz konnektif doku bantlarıdır. Hastalar asemptomatik olabilir, kord basısı ve beyin omurilik sıvısının akım dinamiğinin bozulması ile ilişkili semptomatik durumlar ile başvurabilirler. Araknoidal web'lerin kendisi, görüntüleme yöntemleri ile genellikle ayırt edilemese de oldukça spesifik ancak patognomonik olmayan ''Neşter işareti (Scalpel sign) ''nin varlığı bu antitenin tanılandırılmasında önemlidir. Manyetik rezonans görüntüleme tanı için en yararlı modalitedir. Bu olgu sunumunda, nadir görülen bir antite olan torasik araknoidal web tanısı alan 39 yaşındaki bir hastanın klinik ve radyolojik bulgularını sunduk.
Anahtar Kelimeler: *Neşter işareti, Manyetik rezonans Görüntüleme, Araknoidal Web*

INTRODUCTION

Arachnoid webs are intradural, extramedullary, transverse tissue bands extending to the pial surface of the spinal cord, causing focal indentation on the dorsal spinal cord (1). They are considered to form due to thickening of the intradural arachnoid layer caused by blood products accumulating after subarachnoid hemorrhage following spinal trauma or previous surgery (2). There are also theories suggesting that arachnoid webs may represent incomplete or degenerative forms of arachnoid cysts (3). Patients typically present with complaints of pain, weakness, and numbness in both lower extremities. Arachnoid webs are relatively rare and can be overlooked due to subtle radiological findings (4).

Magnetic resonance imaging (MRI) is the gold standard diagnostic modality; however, due to the thin structure of the webs compared to adjacent tissues, MRI is not optimally sensitive in demonstrating these bands (5). Extramedullary transverse bands lead to the expansion of the posterior subarachnoid cerebrospinal fluid (CSF) space and flattening of the dorsal spinal cord, creating the "scalpel sign." This term refers to the mass effect on the dorsal spinal cord caused by CSF accumulation in the subarachnoid space, resembling a surgical scalpel with its blade facing posteriorly. The scalpel sign, seen in MRI and computed tomography (CT) myelography, is a highly specific indicator suggestive of arachnoid webs (5-7). In this report, we aim to highlight the diagnostic imaging features of this rare entity by presenting a case of thoracic arachnoid web.

CASE REPORT

A 39-year-old female presented to the neurosurgery outpatient clinic with complaints of neck and right upper arm pain persisting for several months. The patient had no history of chronic illness, medication use, trauma, or previous surgeries. Neurological examination of the motor and sensory functions of the extremities was normal. Cervical and thoracic MRI was performed with an initial diagnosis of radiculopathy.

In thoracic MRI images, between the T5-T7 levels, expansion of the posterior cerebrospinal fluid (CSF) space consistent with the scalpel sign was observed in the intradural extramedullary region. This was accompanied by flattening of the thoracic cord posteriorly due to compression and anterior displacement of the spinal cord at this level (Figure 1a, 1b). The flattening of the posterior spinal cord at the T5-T7 levels, coupled with the absence of a well-defined cystic lesion, ruled out the

Figure 1a: Sagittal T2-weighted fat-suppressed image showing posterior cerebrospinal fluid (CSF) space expansion consistent with the "scalpel sign" (yellow arrow). The anterior subarachnoid CSF space is clearly visible anterior to the spinal cord (star).

diagnosis of an arachnoid cyst. Furthermore, preservation of the subarachnoid CSF space anterior to the spinal cord and the absence of a characteristic "C"-shaped distortion in the posterior contour of the spinal cord excluded the diagnosis of spinal cord herniation. Based on these imaging findings, the condition was evaluated as consistent with thoracic arachnoid web. Follow-up imaging was not available for this case. Figure 1c provides a diagrammatic representation of a thoracic arachnoid web, depicting its intrusion into the posterior CSF space and the resultant slight cranial displacement of the spinal cord, forming the scalpel sign (Figure 1c).

DISCUSSION

Arachnoid webs are rare entities. In a recent study, Naggar et al. stated that there were 196 cases that had been reported to date (11). Despite their rarity, the literature indicates that undiagnosed arachnoid webs can result in significant neurological deficits that can lead to morbidity (8). This case report aims to emphasize the pathophysiology, clinical findings, diagnostic imaging characteristics, and treatment modalities associated with arachnoid webs.

Arachnoid webs present with symptoms such as myelopathy, radiculopathy, neurogenic back pain, urinary incontinence, and motor or sensory deficits, as well as findings such as hyperreflexia due to spinal cord compression and CSF flow disturbance (8-10). The pathophysiology of arachnoid webs has been associated with several theories. These include the

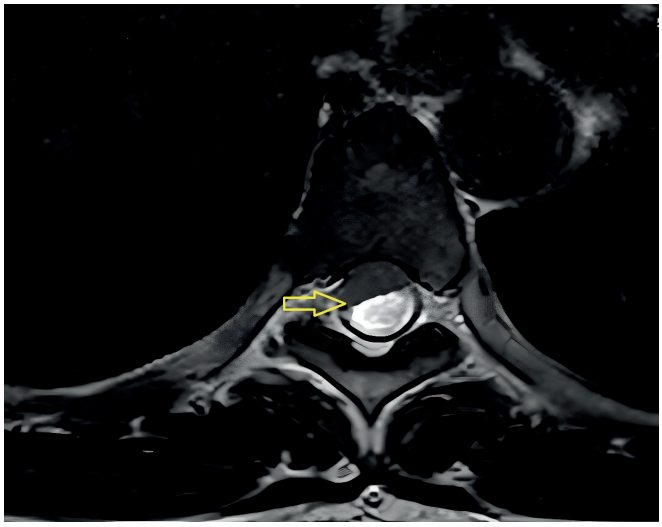

Figure 1b: Axial T2-weighted fat-suppressed image showing flattening of the posterior spinal cord and anterior displacement of the spinal cord (yellow arrow).

possibility that thickening of the intradural arachnoid layer may result from products formed due to prior infections, trauma, or surgical interventions. Additionally, arachnoid webs may develop secondary to degenerated or ruptured arachnoid cysts. Another theory links their development to arachnoiditis associated with the inflammatory response of CD3-positive T cells (2,3,10-12).

In the literature, arachnoid webs are almost exclusively localized to the thoracic level. According to our review, only one case of non-thoracic localization has been reported, a cervical arachnoid web presented in a study by Yamamoto et al. (3). The predominance of thoracic-level cases supports the hypothesis that arachnoid webs develop from septum posticum diverticula as part of the arachnoid cyst formation theory (13). Although not observed in our case, syringomyelia frequently accompanies arachnoid webs (3,4,10-13). Arachnoid webs are considered to obstruct the longitudinal flow of CSF and progressively alter CSF dynamics, leading to syrinx formation (4,11,12). Syrinx cavities can occur either rostrally

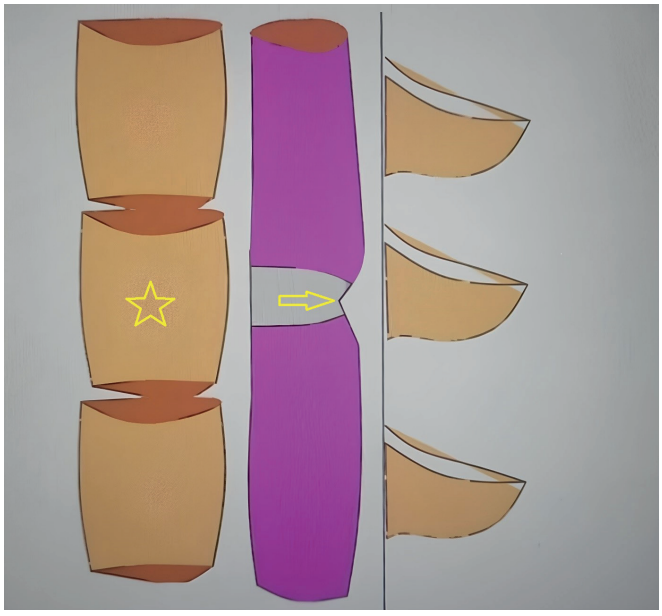

Figure 1c: Axial T2-weighted fat-suppressed image showing flattening of the posterior spinal cord and anterior displacement of the spinal cord (yellow arrow).

or caudally to the level of the arachnoid web, depending on CSF pressure differentials (12).

Due to the thin structure of arachnoid webs, they are not always visible on MRI or CT myelography (1,3,4). Posterior subarachnoid CSF space expansion, ventral cord displacement, and posterior cord compression seen as the scalpel sign are highly sensitive findings in these imaging modalities (10-13). In the literature, only Choi et al. have reported a thoracic arachnoid web case where the scalpel sign was not observed (8). Although arachnoid webs may not be distinguishable in routine MRI, studies suggest that they can be visualized using high spatial resolution MRI sequences such as constructive interference in steady state (CISS) (5,6,11). Additionally, MRI cine sequences and CSF flow studies can demonstrate obstructions or disruptions in CSF flow (11).

The differential diagnosis of arachnoid webs includes arachnoid cysts, spinal cord herniations, and arachnoiditis ossificans (4). Arachnoid cysts are often distinguished by well-defined cyst margins, slower filling of the cyst on CT myelography or CSF flow imaging, and spinal cord displacement without the scalpel sign. Spinal cord herniations are characterized by obliteration of the anterior subarachnoid space and the characteristic C-shaped distortion of the posterior cord contour. Arachnoiditis ossificans can be readily identified by the presence of calcified foci on CT myelography and the absence of the scalpel sign (4,9,10-13).

Surgical treatment should be considered in patients with symptomatic cord compression and CSF flow blockage caused by arachnoid webs (7). Surgical approaches typically involve laminectomy or hemilaminectomy at the level of compression and excision of the arachnoid web (12). Surgical intervention involving laminectomy or hemilaminectomy at the level of compression, followed by excision of the arachnoid band, is the most commonly employed method and is highly effective in alleviating patients' symptoms. To facilitate syrinx drainage, a small midline incision (myelotomy) may be performed at the level of the syrinx's maximum enlargement. A minimally invasive approach involving vertebral laminotomy is also feasible. Intraoperatively, ultrasound can be utilized to visualize the arachnoid band, locate its position prior to durotomy, ensure complete resection of the arachnoid web, and confirm the restoration of normal CSF flow. Postoperative complications are rare and primarily include epidural hematoma, pseudomeningocele, and CSF leakage.

Our case has certain limitations. First, a pathological diagnosis was not obtained, and the diagnosis of dorsal arachnoid web was made solely based on radiological findings. Second, follow-up imaging and imaging from different modalities such as CT myelography were not available for the case.

In conclusion, arachnoid webs are rare entities, and diagnostic delays may result in progressive neurological deficits. Arachnoid webs are generally not directly visualized in routine MRI examinations. The scalpel sign is a highly specific finding for diagnosing arachnoid webs. Differential diagnoses for arachnoid webs include arachnoid cysts, spinal cord herniations, and arachnoiditis ossificans.

Conflict of Interest: No conflict of interest was declared by the authors
Ethics: The authors certify that they have obtained all appropriate patient consent forms.
Funding: There is no financial support of any person or institution.
Approval of final manuscript: All authors.

REFERENCES

1. Reardon MA, Raghavan P, Carpenter-Bailey K, Mukherjee S, Smith JS, Matsumoto JA, et al. Dorsal thoracic arachnoid web and the "scalpel sign": a distinct clinical-radiologic entity. AJNR Am J Neuroradiol. 2013;34(5):1104-1110. doi: 10.3174/ajnr. A3432.
2. Saiz A, Sanz Díaz J, Peña Suarez J, Santamarta E, Martínez L, Suárez Arcay C, et al. Advanced MRI techniques in arachnoid web diagnosis. ECR 2019/ C-1853. DOI: 10.26044/ecr2019/C-1853
3. Yamamoto A, Fujimoto M, Aoki K, Suzuki Y, Mizuno M, Suzuki H. A Dorsal Arachnoid Web of the Cervical Spine: A Case Report. NMC Case Rep J. 2021;8(1):281-286. doi: 10.2176/nmccrj.cr.2020-0300.
4. Arora V, Verma H, Kamal R, Nasir Ahmed L. Dorsal arachnoid web: the 'scalpel' sign -a case report and differential diagnosis. Egypt J Radiol Nucl Med 53, 163 (2022). https://doi.org/10.1186/s43055-022-00847-4
5. Ben Ali H, Hamilton P, Zygmunt S, Yakoub KM. Spinal arachnoid web-a review article. J Spine Surg. 2018;4(2):446-450. doi: 10.21037/jss.2018.05.08.
6. Buttiens A, Feyen B, Dekeyzer S. Dorsal Arachnoid Web: A Rare Cause of Myelopathy. J Belg Soc Radiol. 2021;105(1):88. doi: 10.5334/jbsr.2592.
7. Derouen K, Shelvin KB, Payton T, Crabill GA, Wilson JM, Tender G. Arachnoid webs with spinal cord compression: insights from three cases. J Surg Case Rep. 2023;16(12): rjad662. doi: 10.1093/jscr/rjad662.
8. Choi JW, DeSimone KE, Dacumos VM, Hoshide RR, Qiao Y, Hui FK. Scalpellum occulta: A rare case of dorsal spinal arachnoid web without the scalpel sign. Radiol Case Rep. 2024;19(4):1552-1555. doi:10.1016/j.radcr.2024.01.036
9. Halloran PJ, Leclair NK, Bulsara KR, Chozick BS, Moss IL, Becker KP, et al. Dorsal arachnoid web of the thoracic spine associated with an arachnoid cyst and a presyrinx state as an unexplained cause of thoracic myelopathy: illustrative case. J Neurosurg Case Lessons. 2024;8(8). doi:10.3171/CASE24313
10. Tran TDD, Vo PD, Truong TV, Ho TD. A case of neurosurgical treatment of thoracic dorsal arachnoid web. Surg Neurol Int. 2023; 14:210. doi:10.25259/SNI_398_2023
11. Naggar A, El Ouali I, Aidi S, Melhaoui A, Kettani NEC, Fikri M, et al. Spinal arachnoid web: a systematic review of a rare entity, with two illustrative case reports. Egypt J Radiol Nucl Med 2024; 55, 178. https://doi.org/10.1186/s43055-024-01348-2
12. Inoue J, Miyakoshi N, Hongo M, Kobayashi T, Abe T, Kikuchi K, et al. Diagnosis and Surgical Treatment of Thoracic Dorsal Arachnoid Web: A Report of Two Cases. Case Rep Orthop. 2020;14(9). https://doi.org/10.1155/2020/8816598
13. Meena VK, Patel TG. Case Series of Arachnoid Webs: Scalpel Sign - A Clue for the Diagnosis. Neurol India. 2023;71(1):153-155. doi:10.4103/0028-3886.370446