Is that a Diverticulum? New Insights in Lateral Leaks

Ajay A. Madhavan, MD

Associate Professor of Radiology

No disclosures

Thanks to…

- Dr. Callen
- Spinal CSF Leak Foundation
- Patients and speakers

Revisiting the types of spinal CSF leaks

Ventral dural tears

- Caused by discogenic bone spicules
- Spine MRI nearly always shows extradural CSF (either “SLEC” or diffuse epidural CSF)
- Patients don’t necessarily have many meningeal diverticula

CSF-venous fistulas

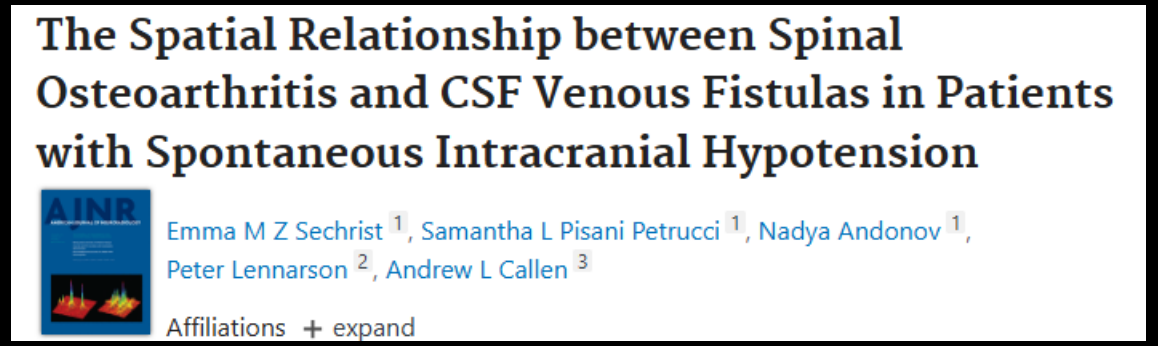
- Many patients have multiple meningeal diverticula
- Discrete “cause” not known
- Associated with prior intracranial hypertension, sometimes elevated BMI, spinal degenerative changes


Spontaneous Spinal CSF Leaks Stratified by Age, Body Mass Index, and Spinal Level

M D Mamlouk [1 2], P Y Shen [3], P Jun [3], M F Sedrak [4]

Affiliations + expand

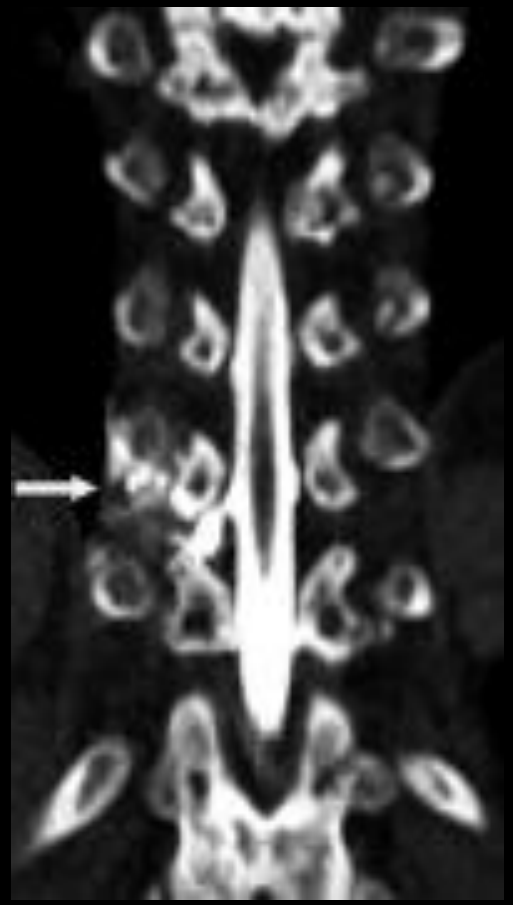
PMID: 35738670 PMCID: PMC9262061 DOI: 10.3174/ajnr.A7548


The Spatial Relationship between Spinal Osteoarthritis and CSF Venous Fistulas in Patients with Spontaneous Intracranial Hypotension

Emma M Z Sechrist [1], Samantha L Pisani Petrucci [1], Nadya Andonov [1], Peter Lennarson [2], Andrew L Callen [3]

Affiliations + expand

Leak into lymphatic malformation



Spontaneous Intracranial Hypotension Associated with Vascular Malformations

Mark D. Mamlouk, Adriana Gutierrez and William P. Dillon

American Journal of Neuroradiology January 2025, DOI: https://doi.org/10.3174/ajnr.A8471

Lateral dural tears

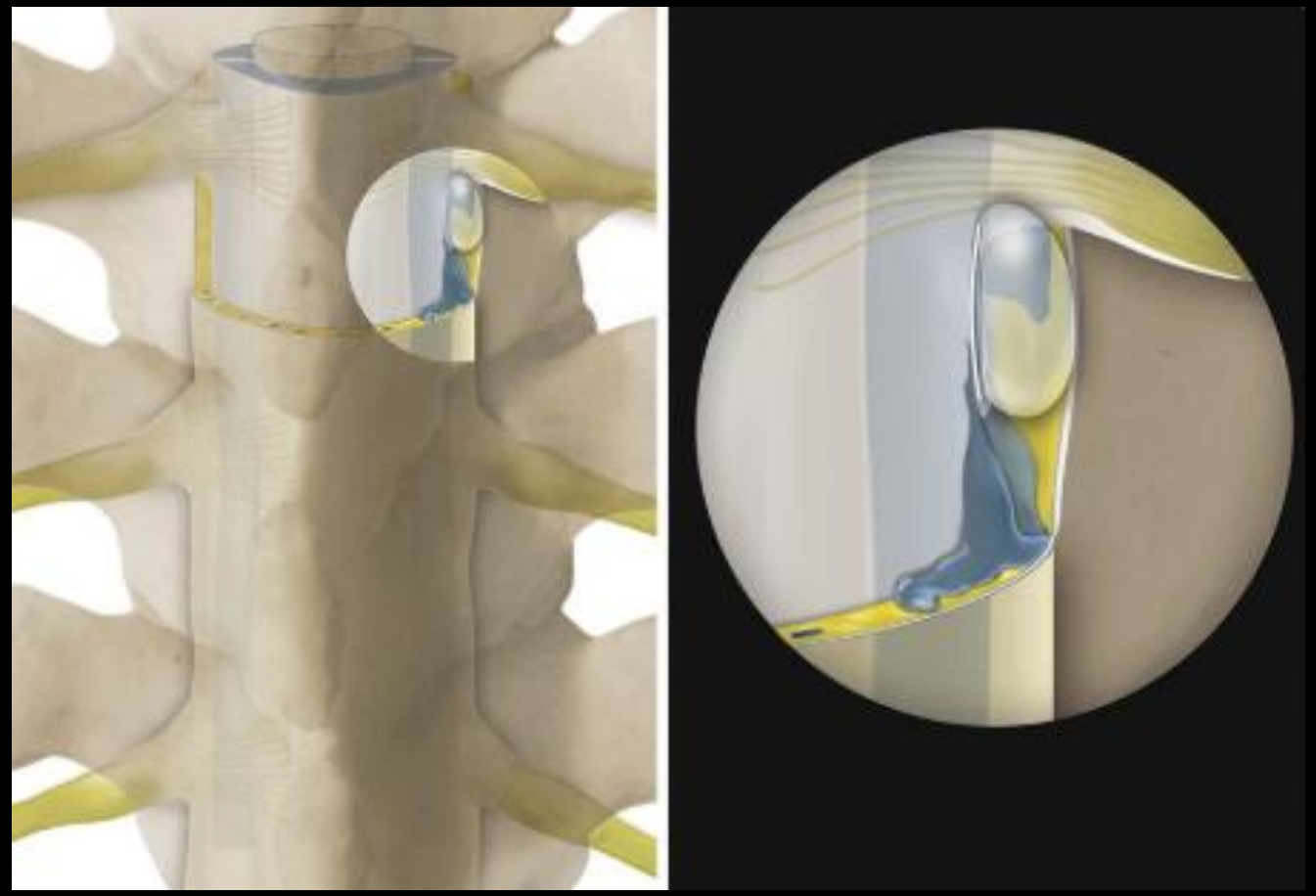
- Less common than ventral dural tears / CSF-venous fistulas
- Relatively young age
- F>M

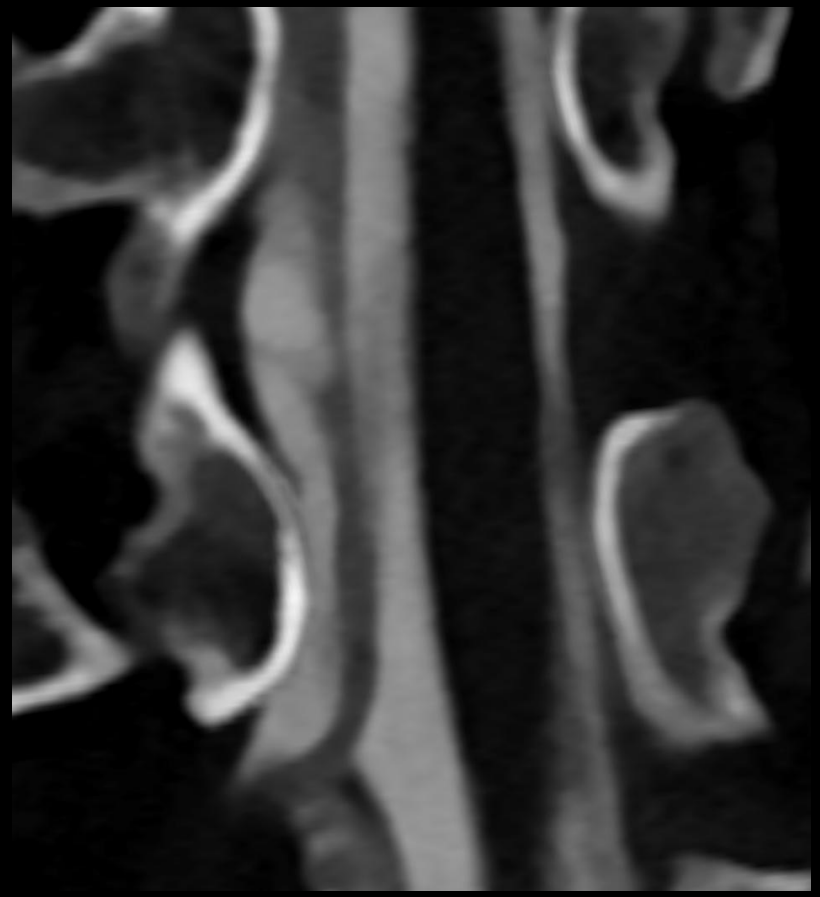
Variables	No. (%)
Age at onset of symptoms (yr)	
Mean (SD)	35.5 (10.8)
Range	12–76
Sex	
Male	16 (30.2)
Female	37 (69.8)
Symptom duration (mo)	
Mean (SD)	35.8 (49.7)
Range	0–205
CSF leak type	
Axilla of nerve root sleeve	36 (67.9)
Pedicle	4 (7.6)
Shoulder of nerve root sleeve	13 (24.5)
CSF leak side[a]	
Left	27 (46.6)
Right	31 (53.4)
CSF leak level[a]	
Cervical	3 (5.7)
Thoracic 4–6	4 (7.8)
Thoracic 7–9	13 (24.5)
Thoracic 10–12	31 (58.5)
Lumbar	2 (3.8)

[a] From a total of 58 CSF leak sites.

Schievink, et al.

Arachnoid outpouching / herniation / diverticulum



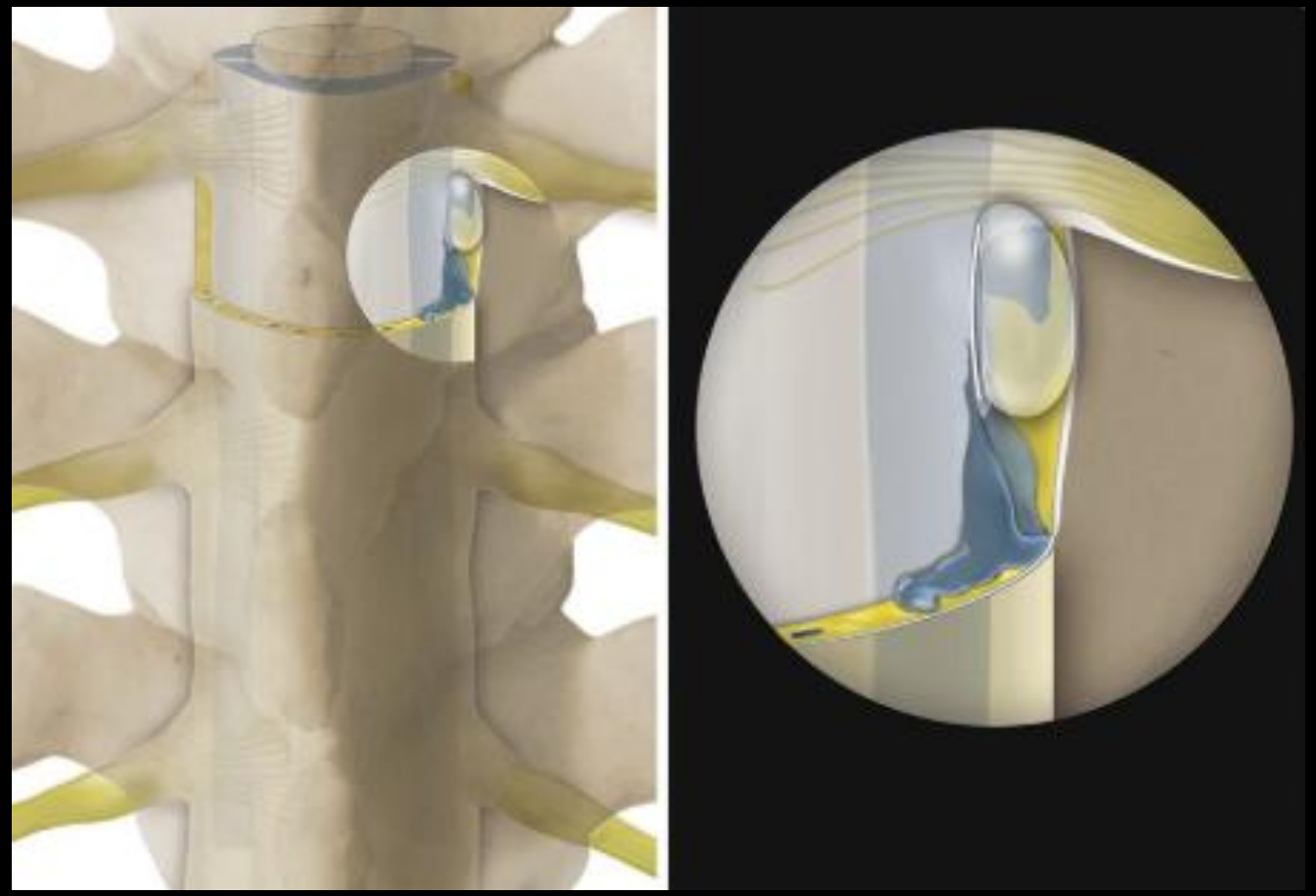


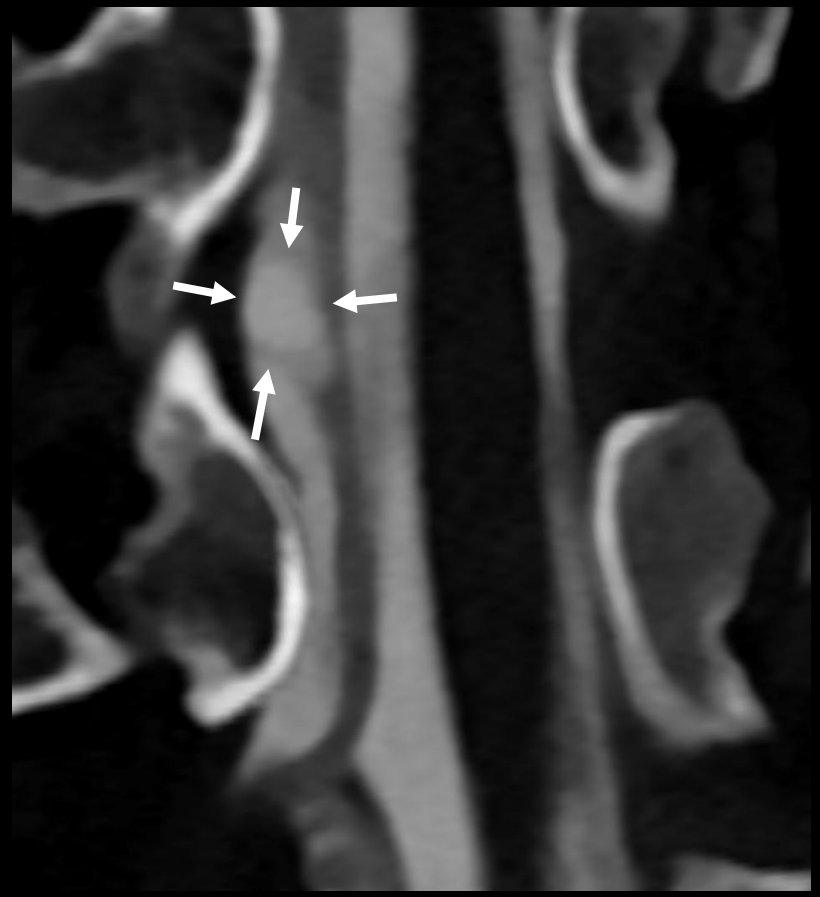
Conventional CT myelogram

Diskogenic microspurs as a major cause of intractable spontaneous intracranial hypotension

Jürgen Beck [1], Christian T Ulrich [2], Christian Fung [2], Jens Fichtner [2], Kathleen Seidel [2], Michael Fiechter [2], Kety Hsieh [2], Michael Murek [2], David Bervini [2], Niklaus Meier [2], Marie-Luise Mono [2], Pasquale Mordasini [2], Ekkehard Hewer [2], Werner J Z'Graggen [2], Jan Gralla [2], Andreas Raabe [2]

Arachnoid outpouching / herniation / diverticulum





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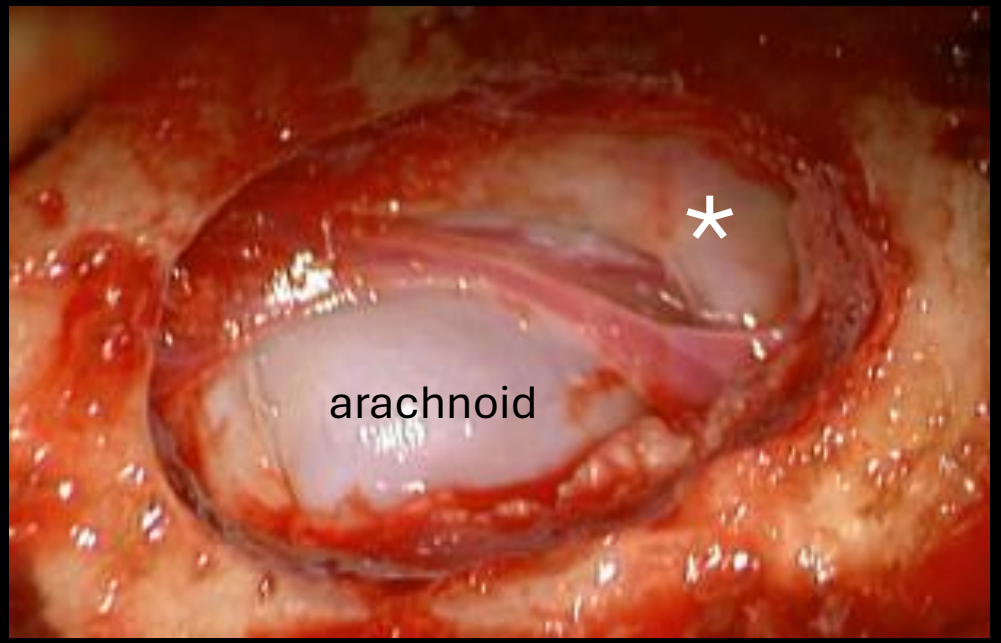
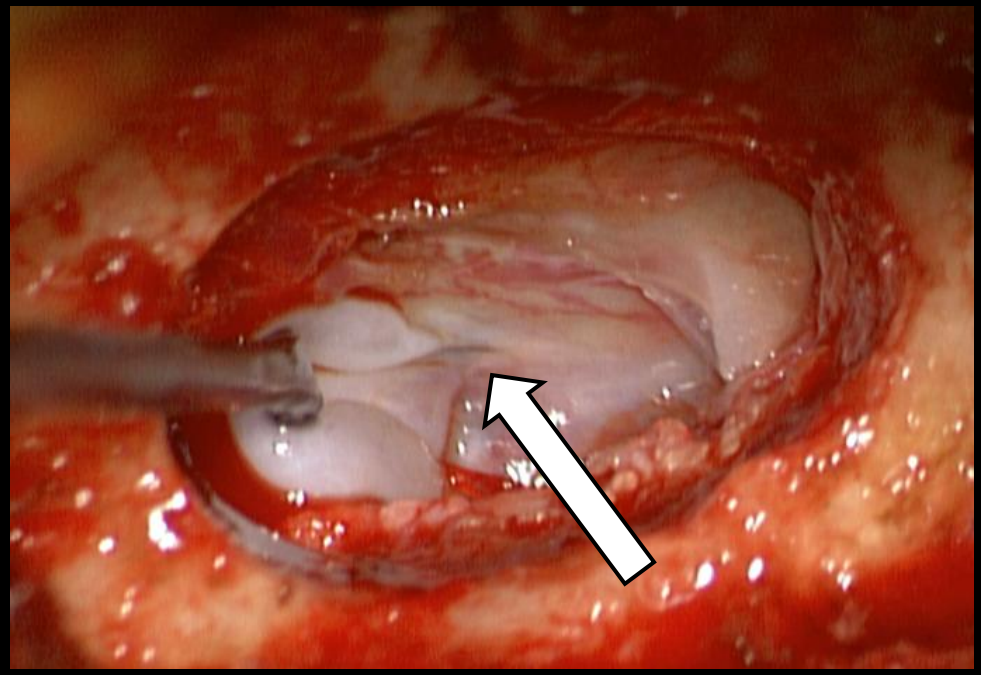
Courtesy Wouter Schievink, MD

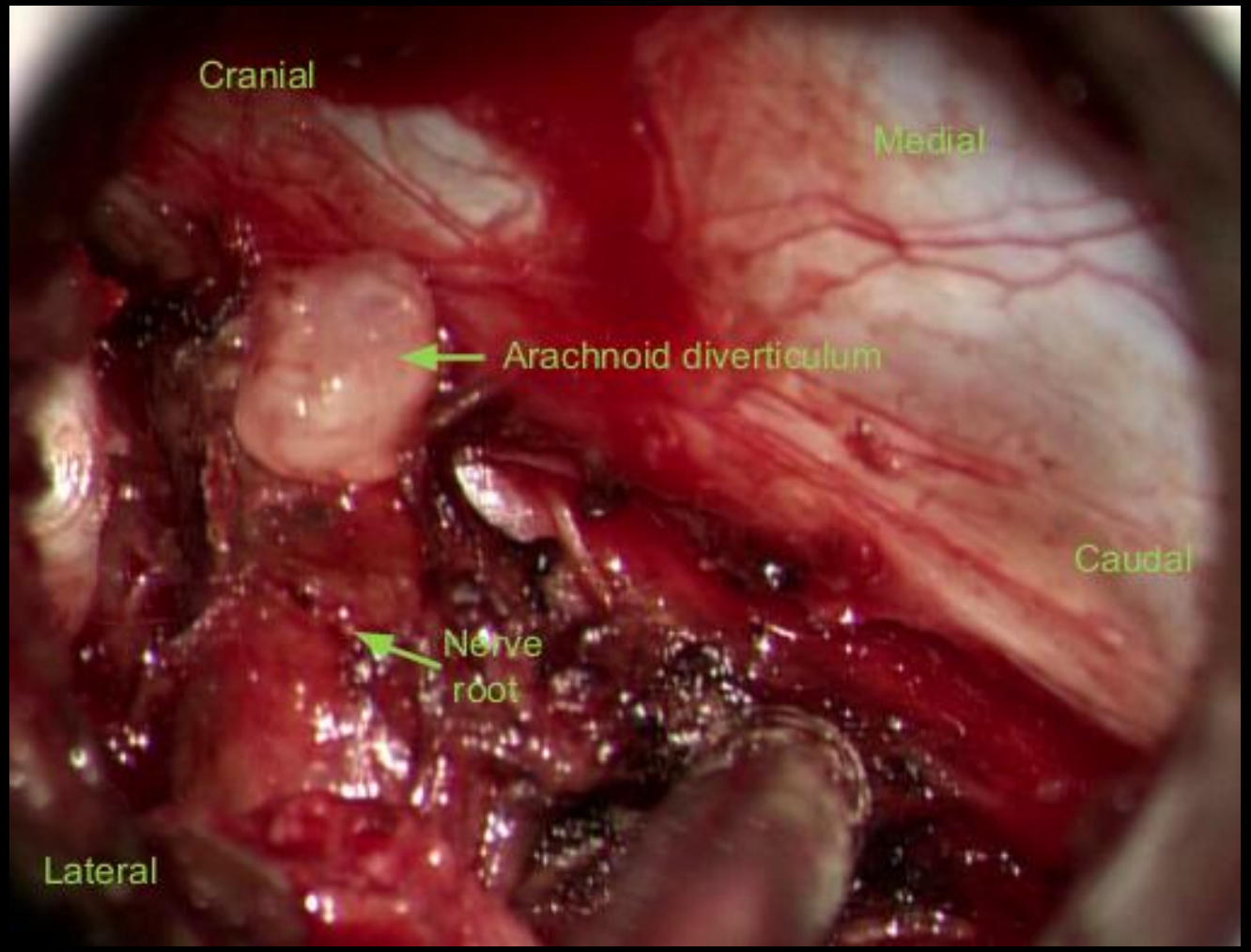




Expounding on the Distinction between Lateral Dural Tears and Leaking Meningeal Diverticula in Spontaneous Intracranial Hypotension

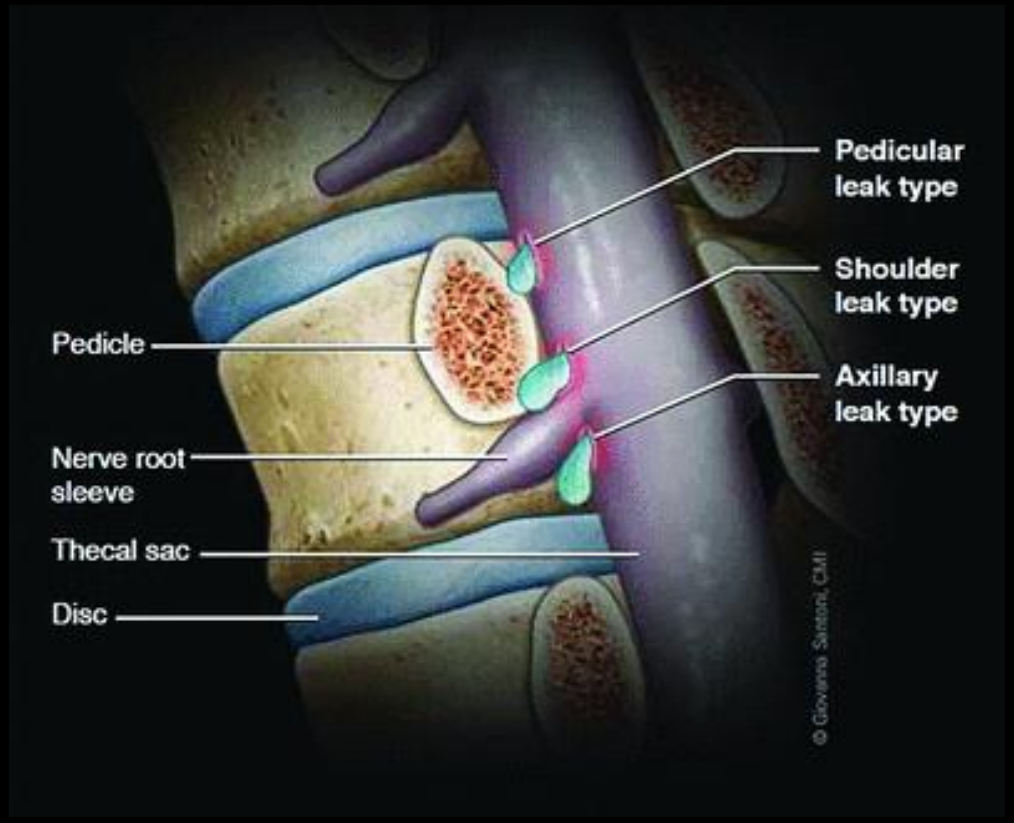
Ajay A. Madhavan, Richard I. Farb, Waleed Brinjikji, Jeremy K. Cutsforth-Gregory and Wouter I. Schievink

American Journal of Neuroradiology August 2024, 45 (8) E28-E29; DOI: https://doi.org/10.3174/ajnr.A8308



Courtesy of Dr. Beck

Subtypes of lateral dural tears



Schievink, et al.

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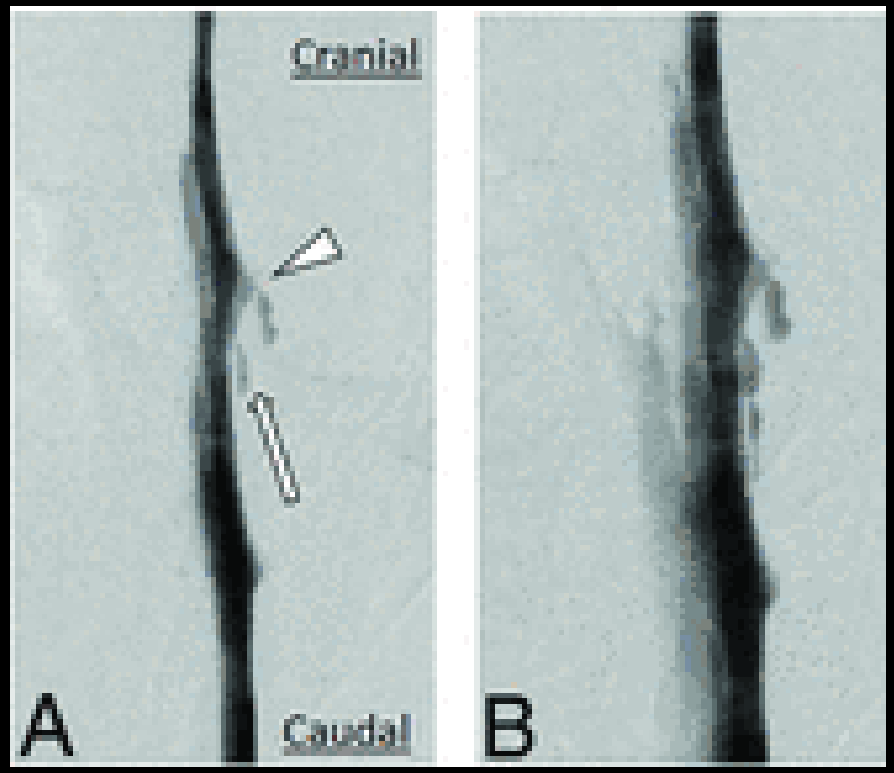
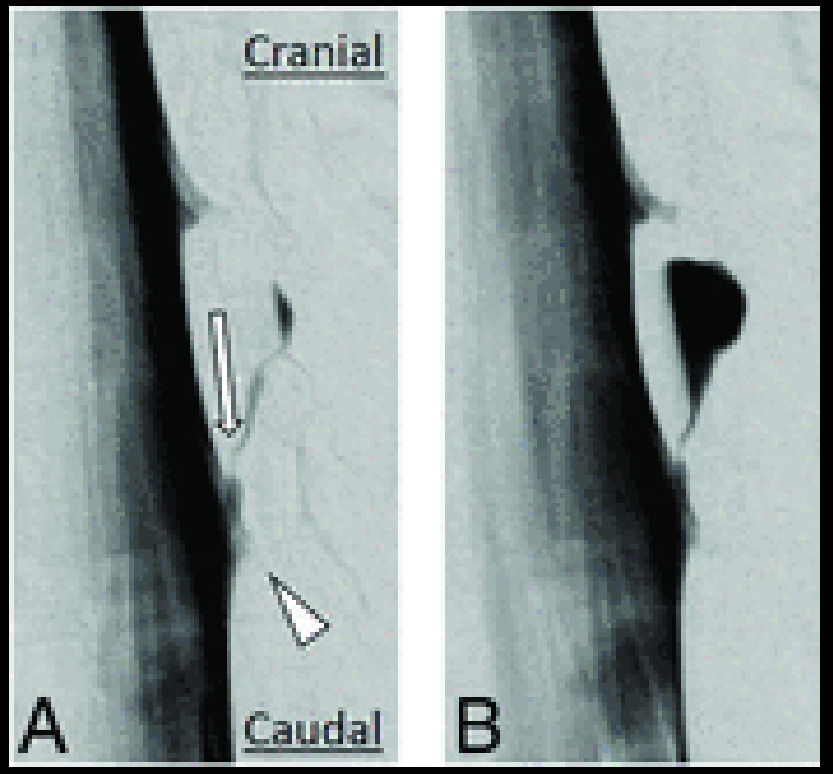


Axillary



Shoulder

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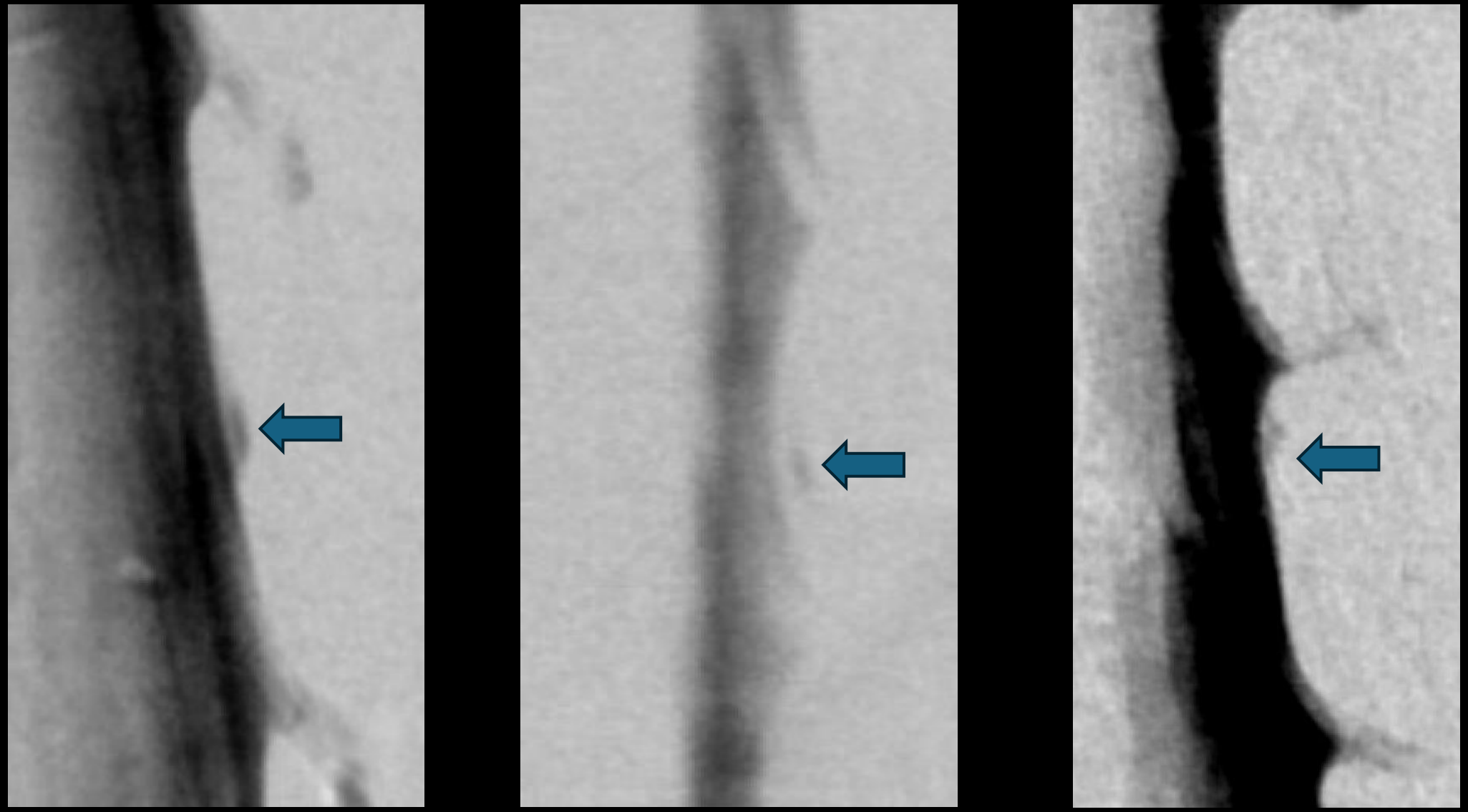
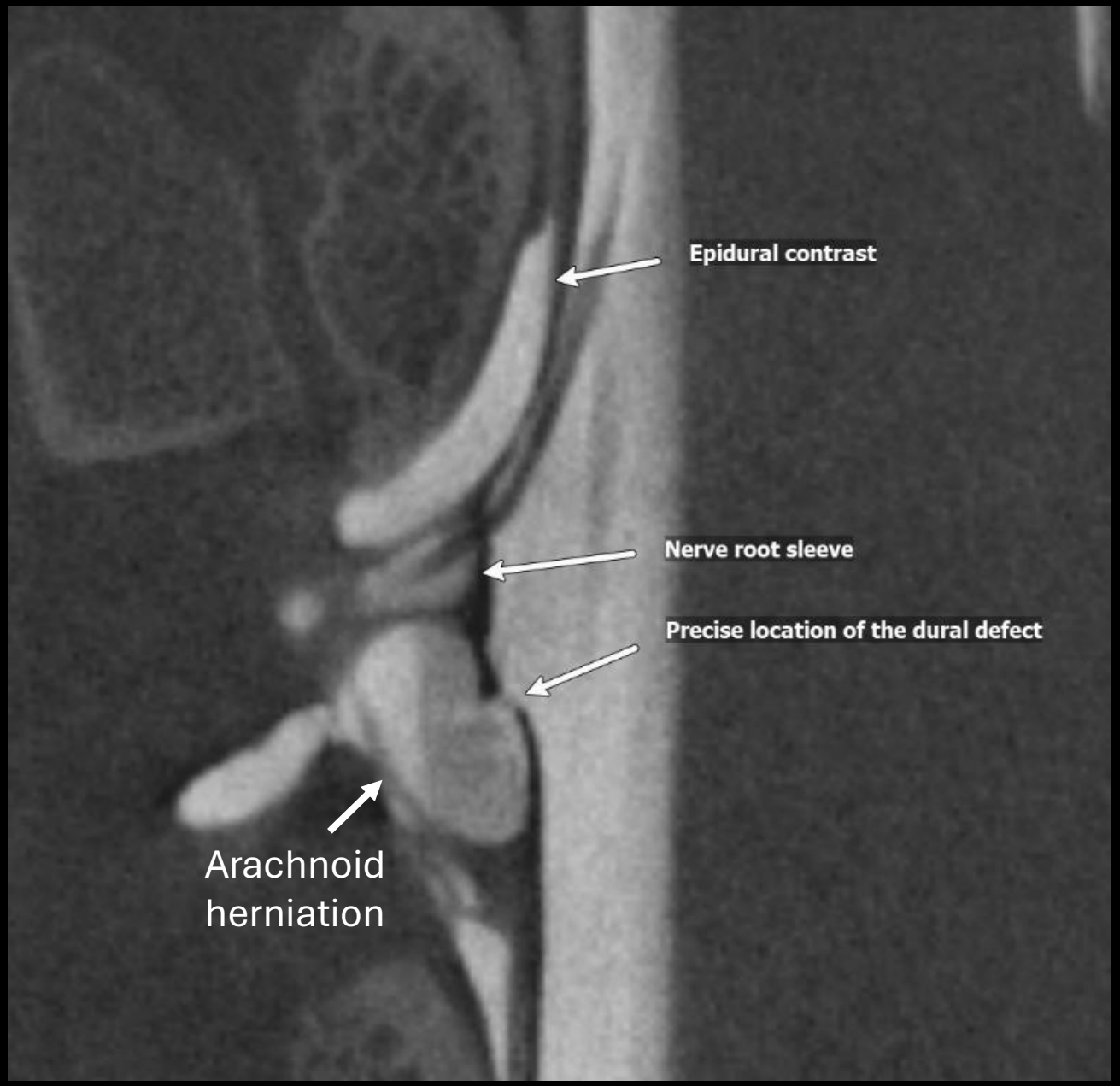
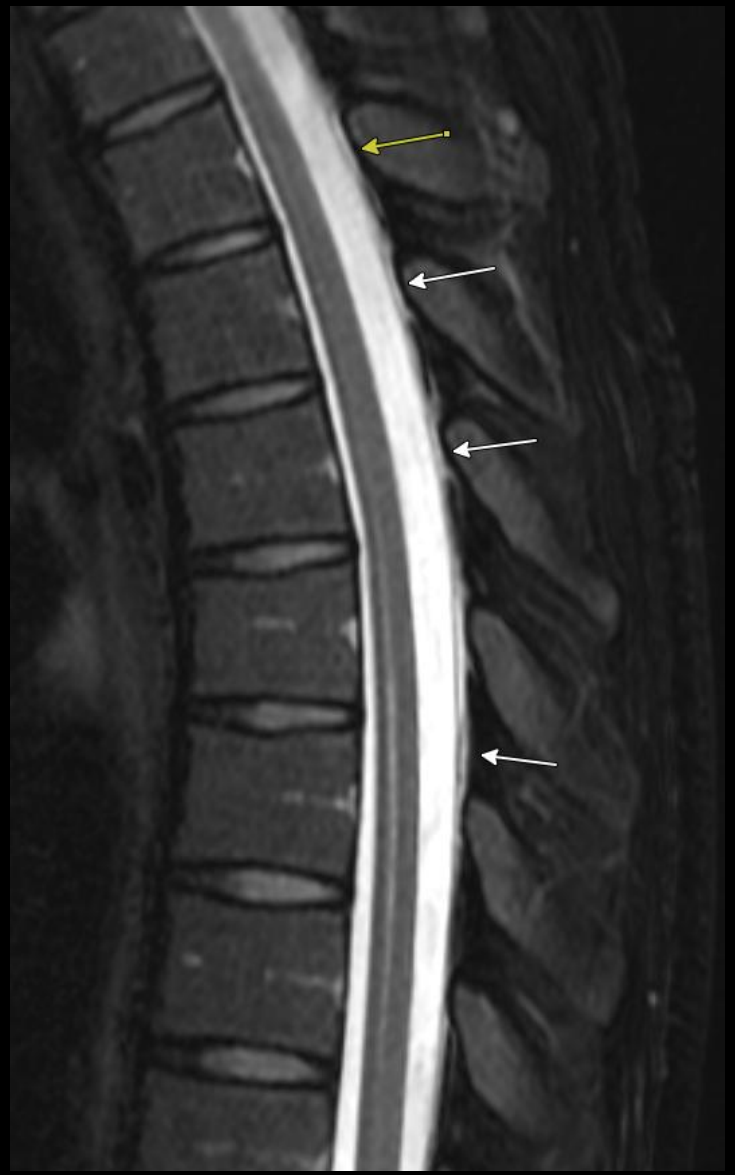
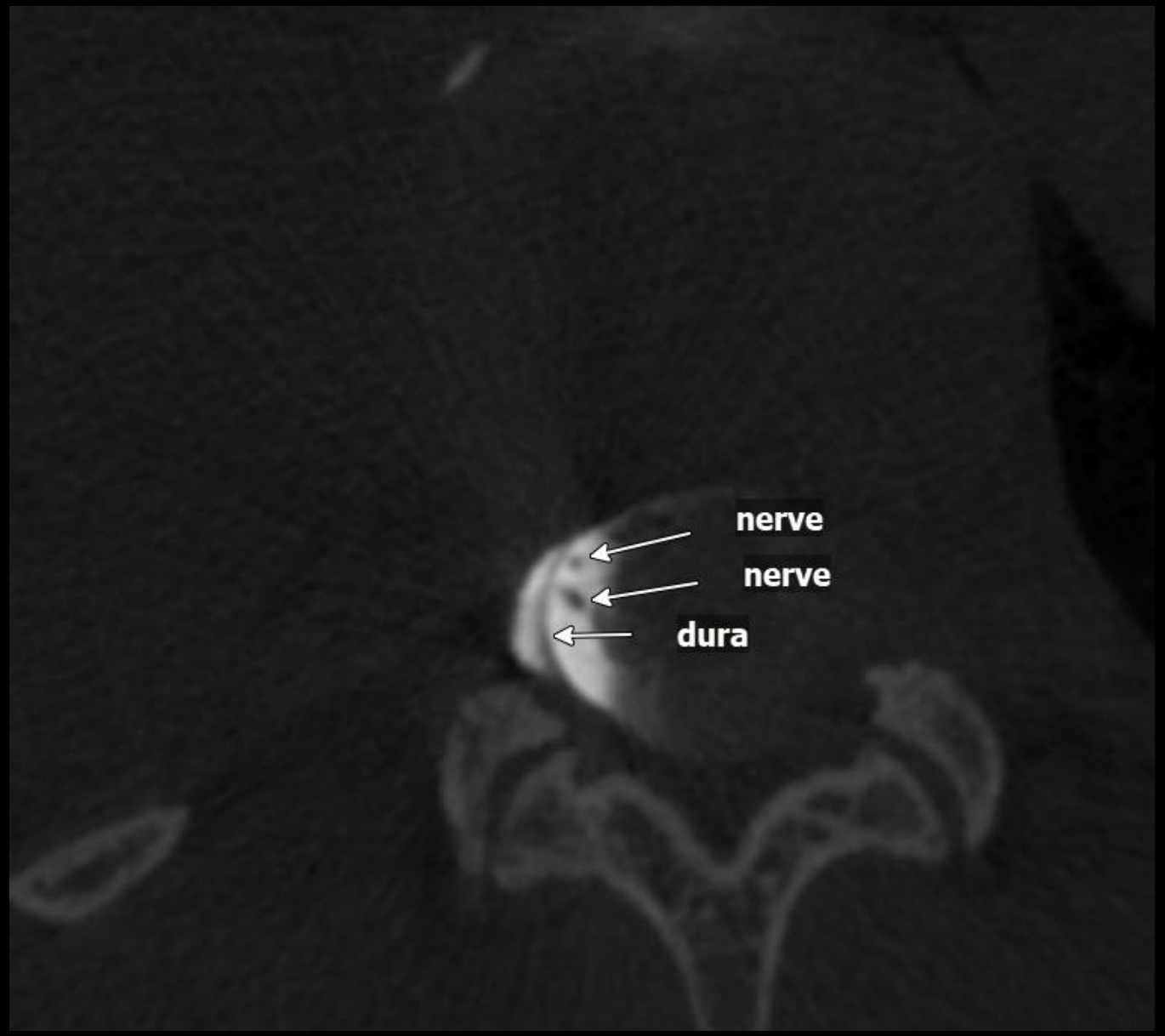


Pedicle level leaks, courtesy of
Dr. Schievink

Illustrative Cases


Epidural contrast
Nerve root sleeve
Precise location of the dural defect
Arachnoid herniation




nerve
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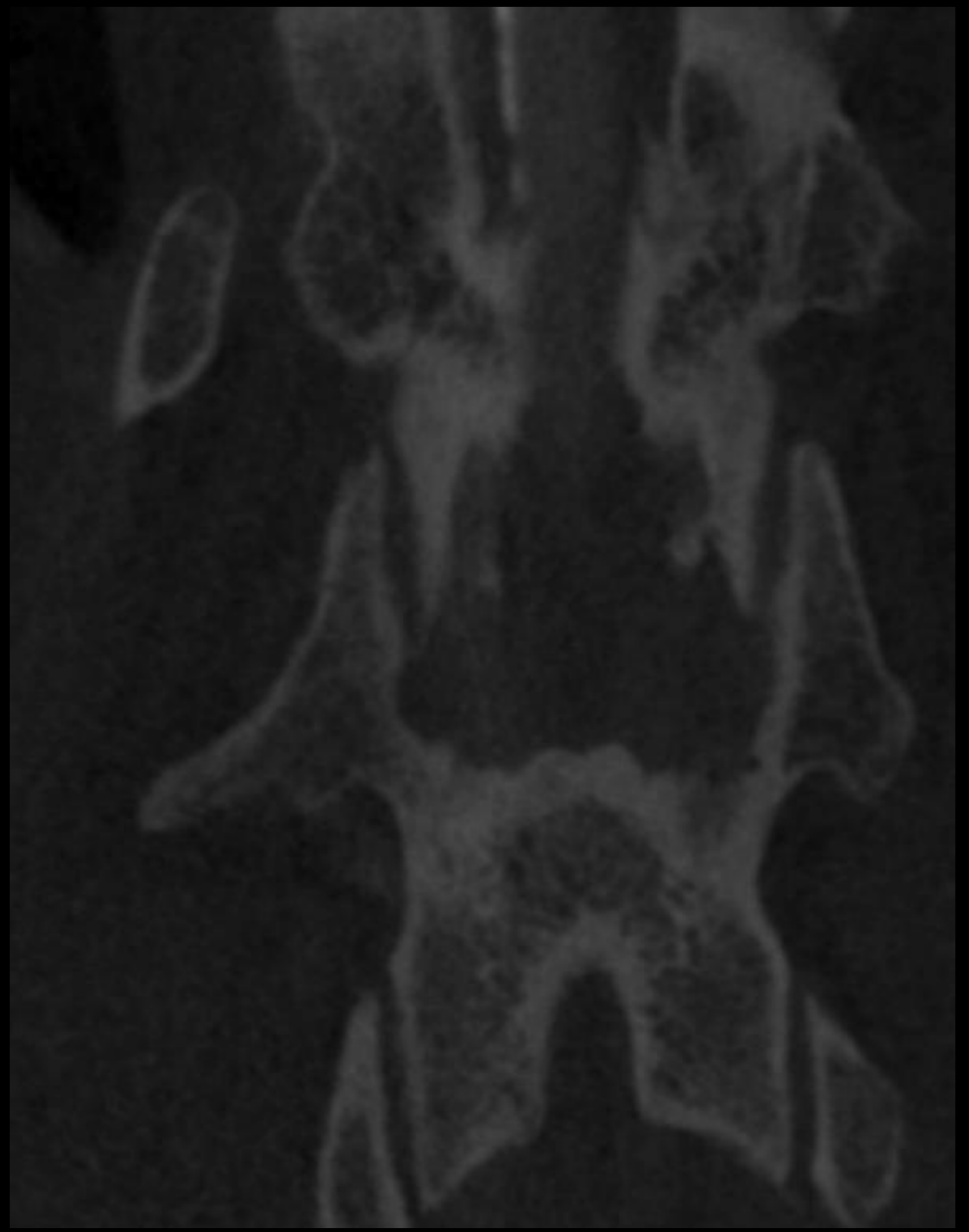
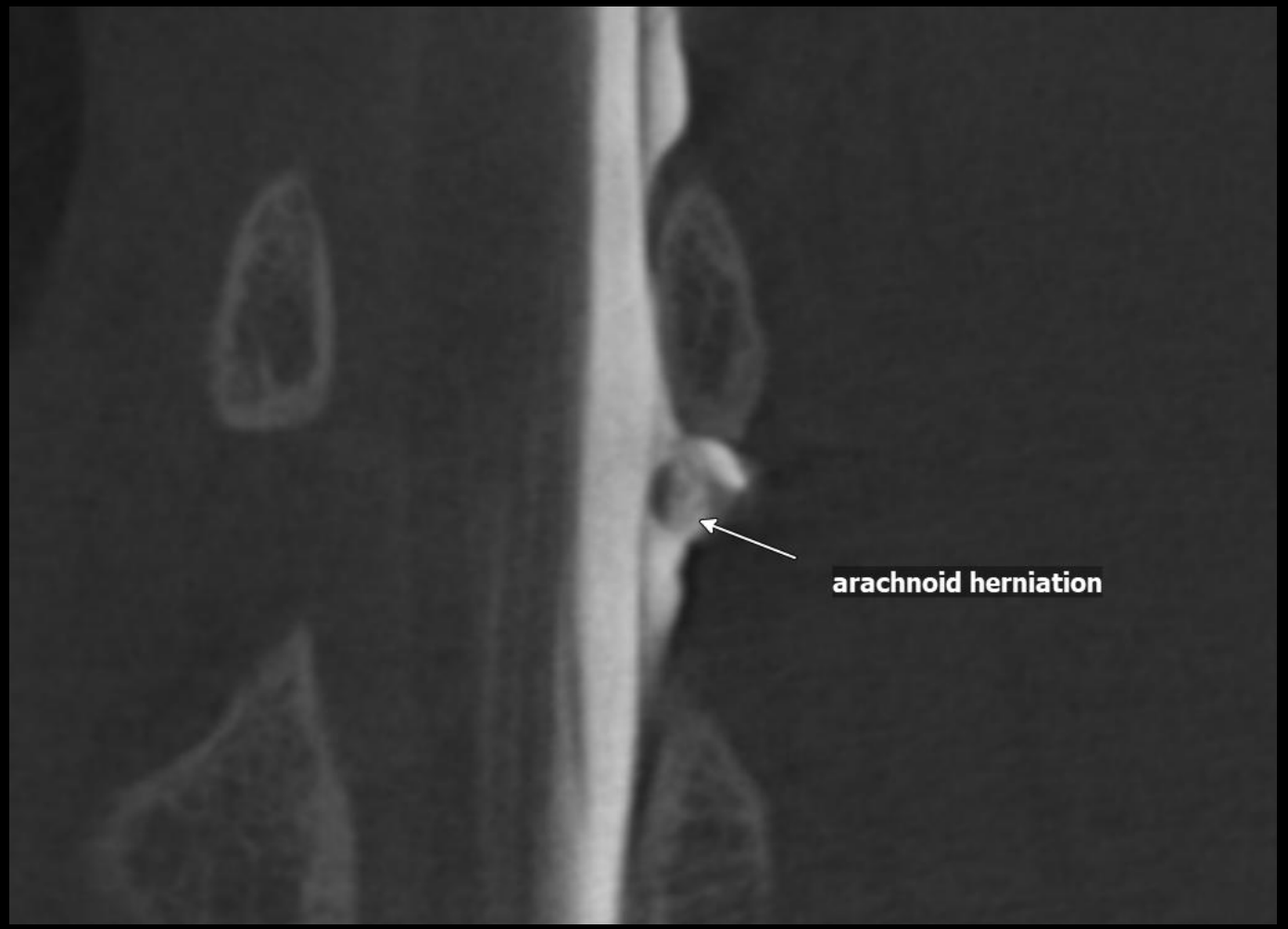
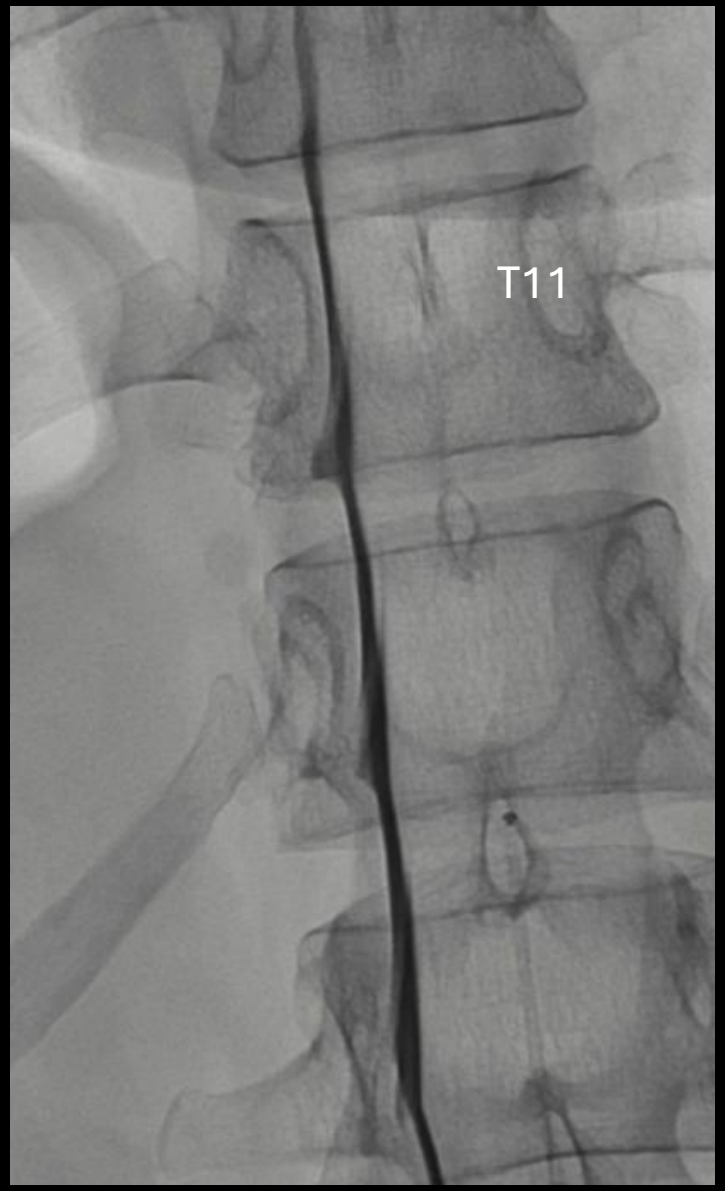



arachnoid herniation

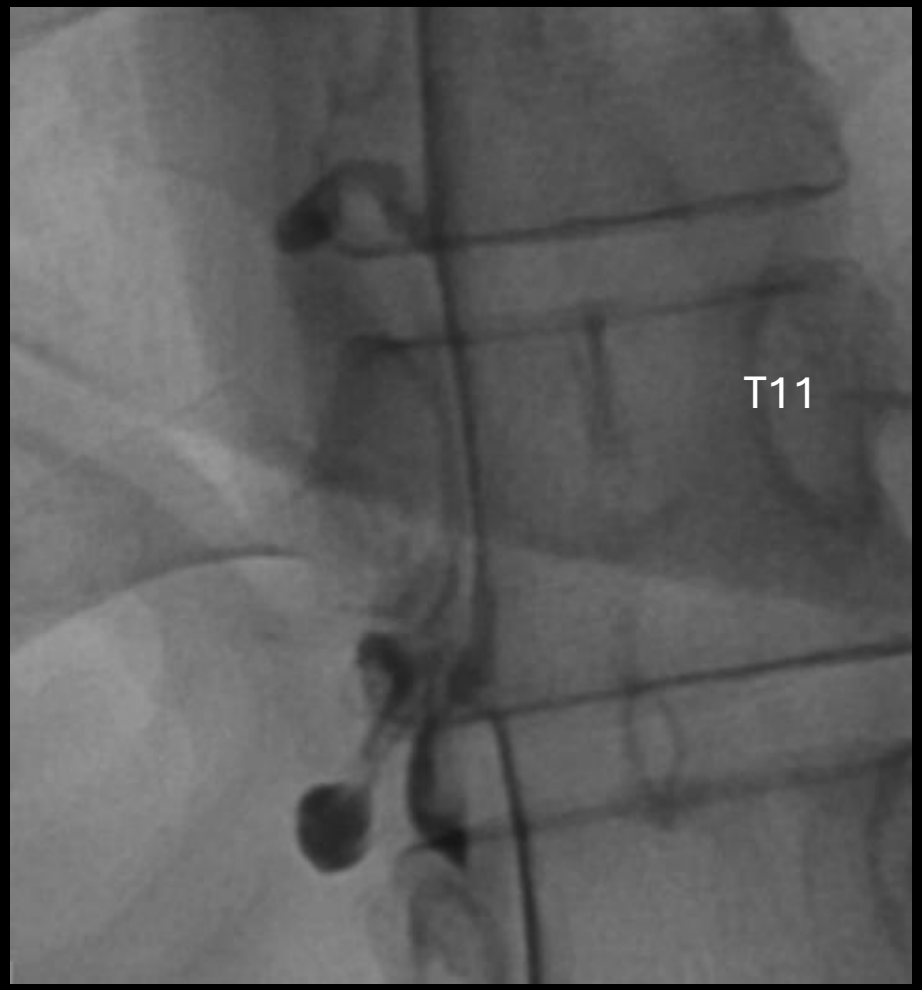
Teaching point: arachnoid herniations can be subtle on imaging (and therefore underrecognized)

Outside MRI (no fat saturated sequences available)

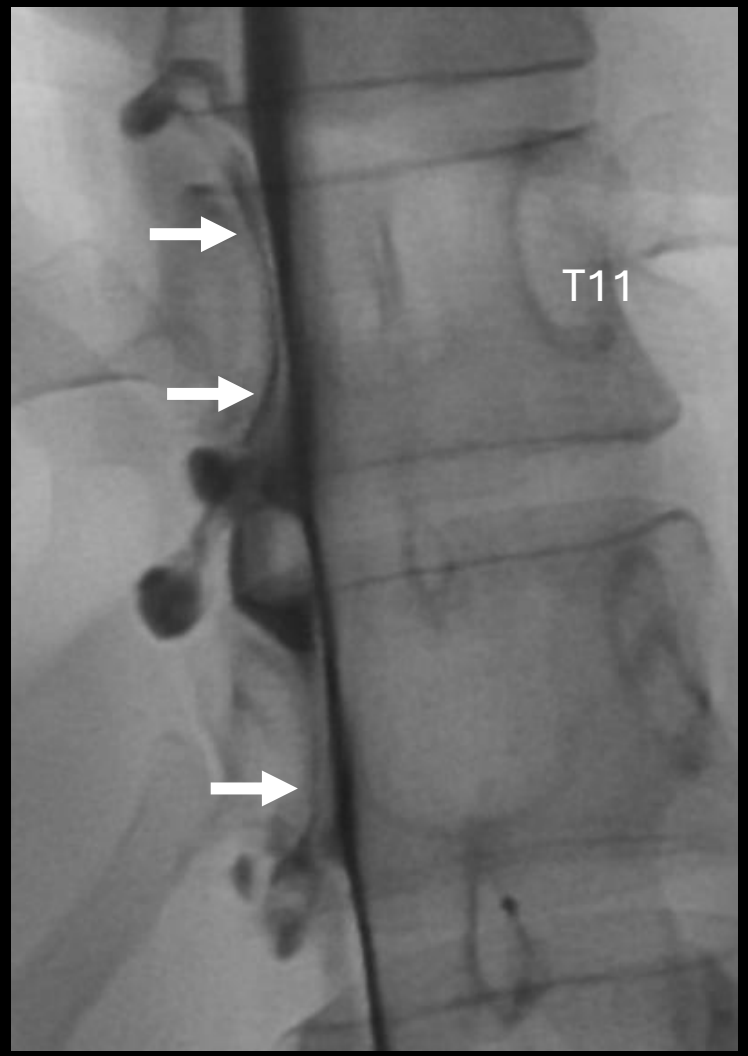
Outside conventional CTM (no obvious epidural CSF)



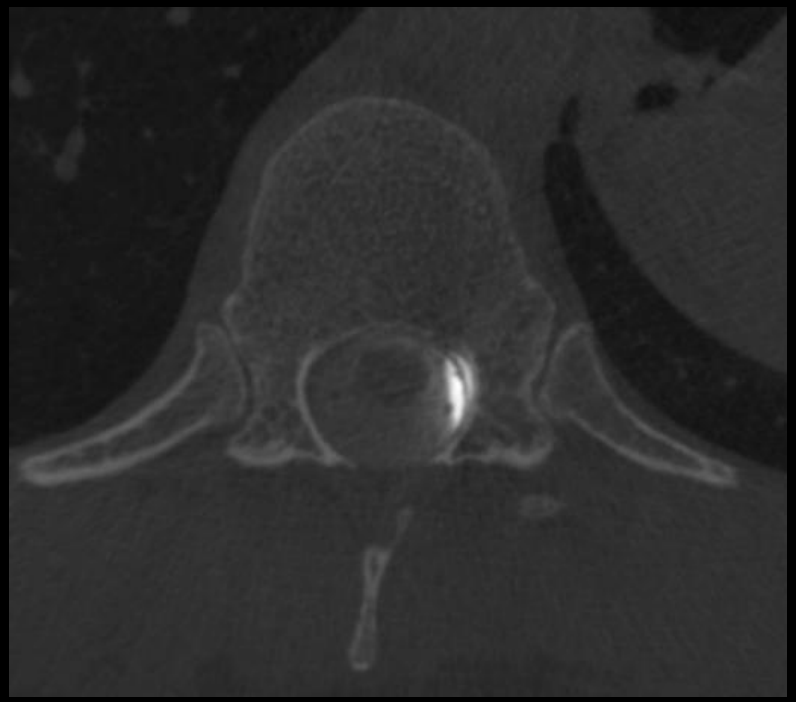
1st DSM run (80 seconds long, 10 mL contrast)

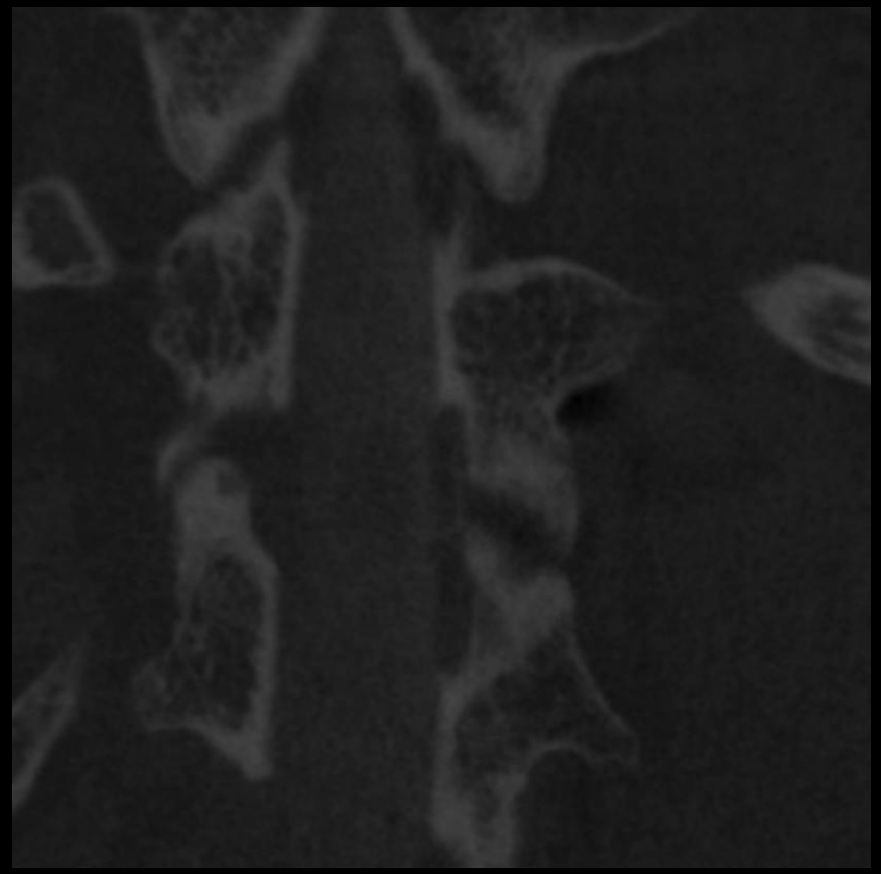


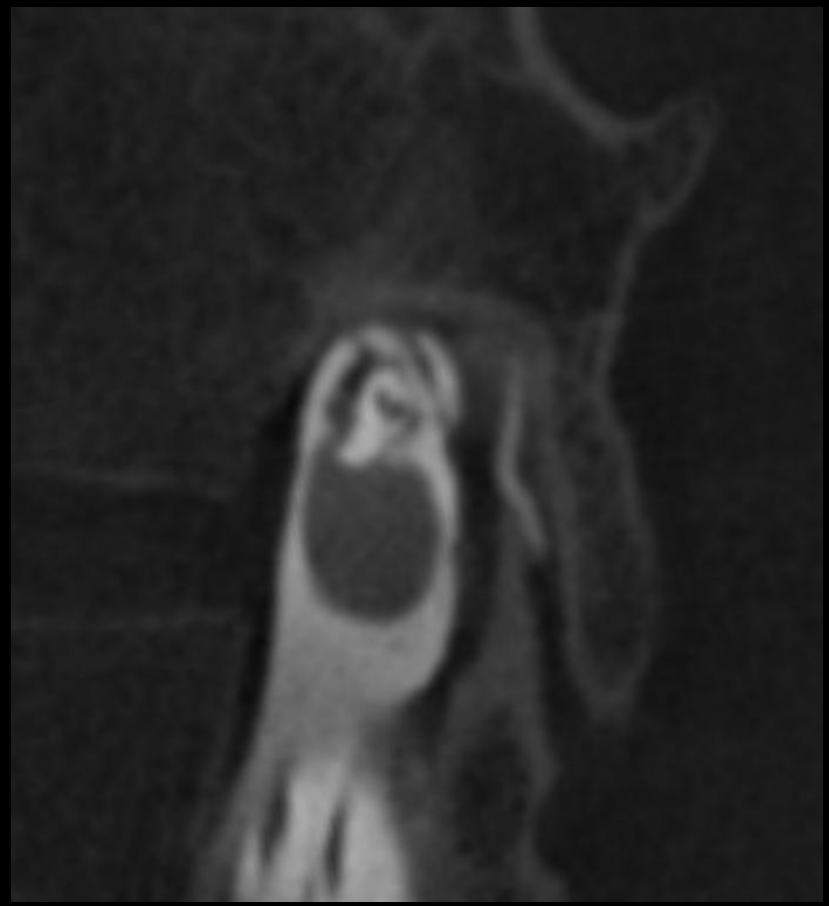
2nd DSM run (30 seconds long, 10 mL contrast)



Spot image 30 seconds later







Teaching points:

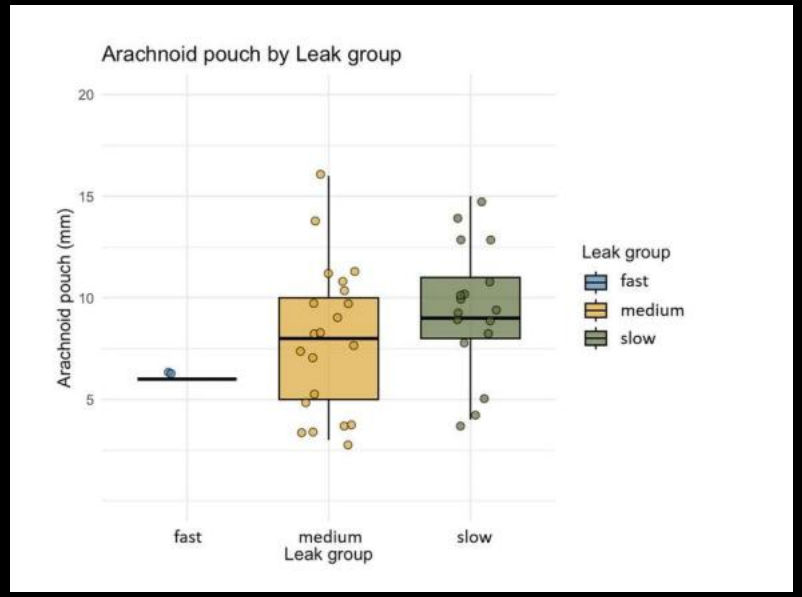
- arachnoid herniations can be large and can cause these to be “slow” leaks
- epidural CSF may be subtle or absent on MRI
- “broad based” diverticulum

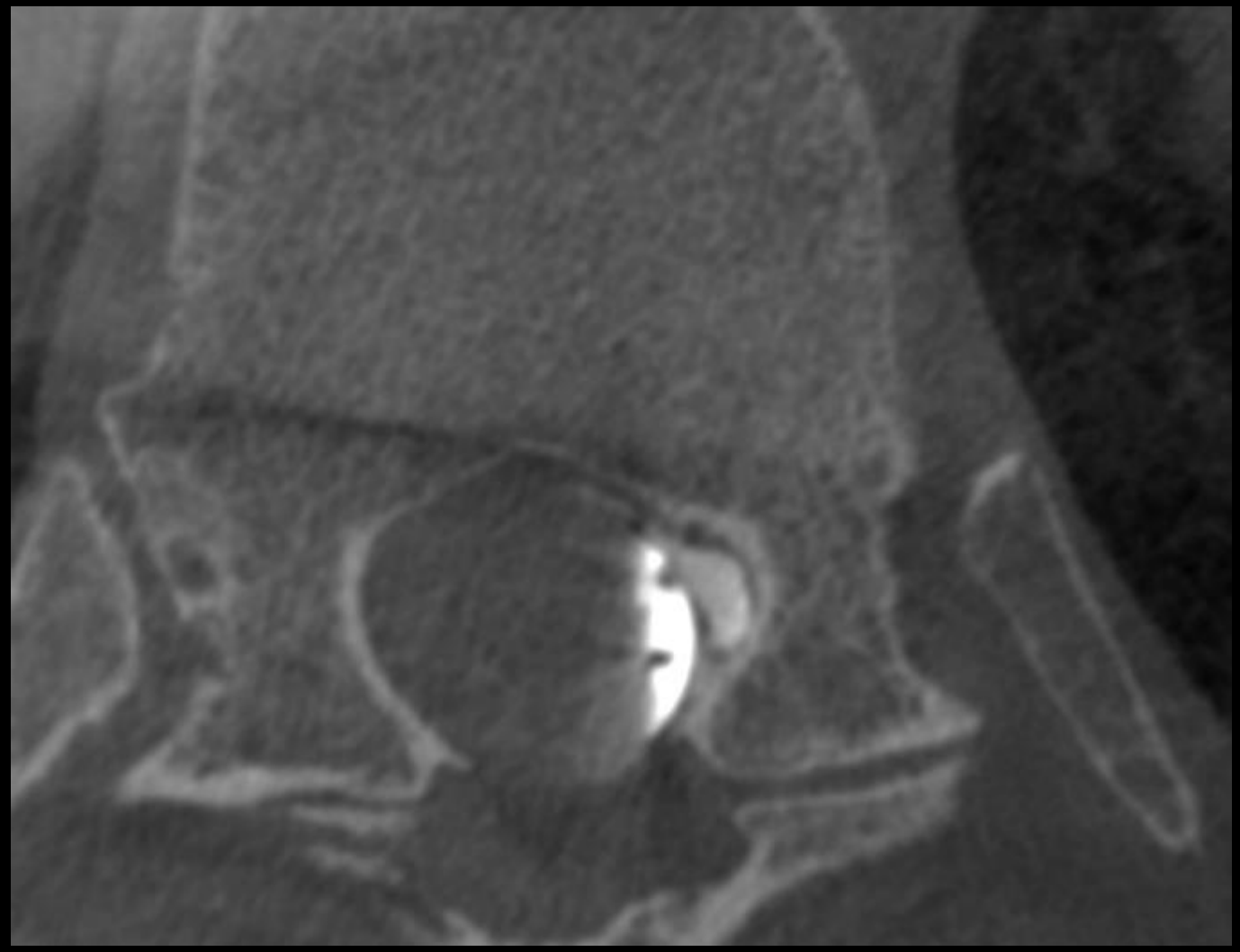
Research Article | Original Research

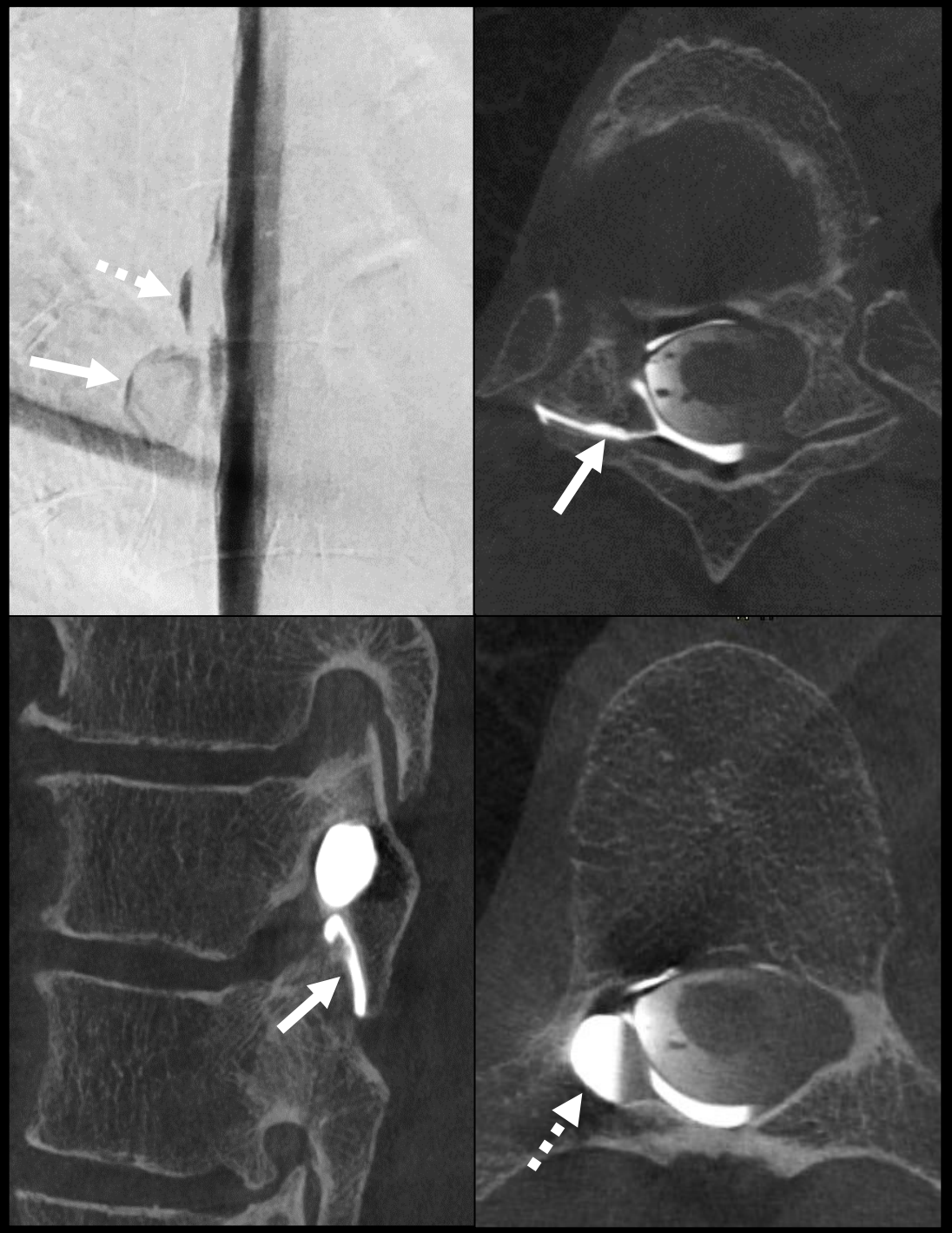
Temporal Characteristics of Type 2 Lateral Spinal CSF Leaks on Digital Subtraction Myelography: Fast, Medium or Slow Leaks?

Niklas Lützen, Horst Urbach, Florian Volz, Amir El Rahal, Katharina Wolf, Laura Krismer, Jürgen Beck and Charlotte Zander

American Journal of Neuroradiology October 2025, ajnr.A9040; DOI: https://doi.org/10.3174/ajnr.A9040







Courtesy of Niklas Lutzen, MD

Teaching point: arachnoid herniations can erode into facet joints

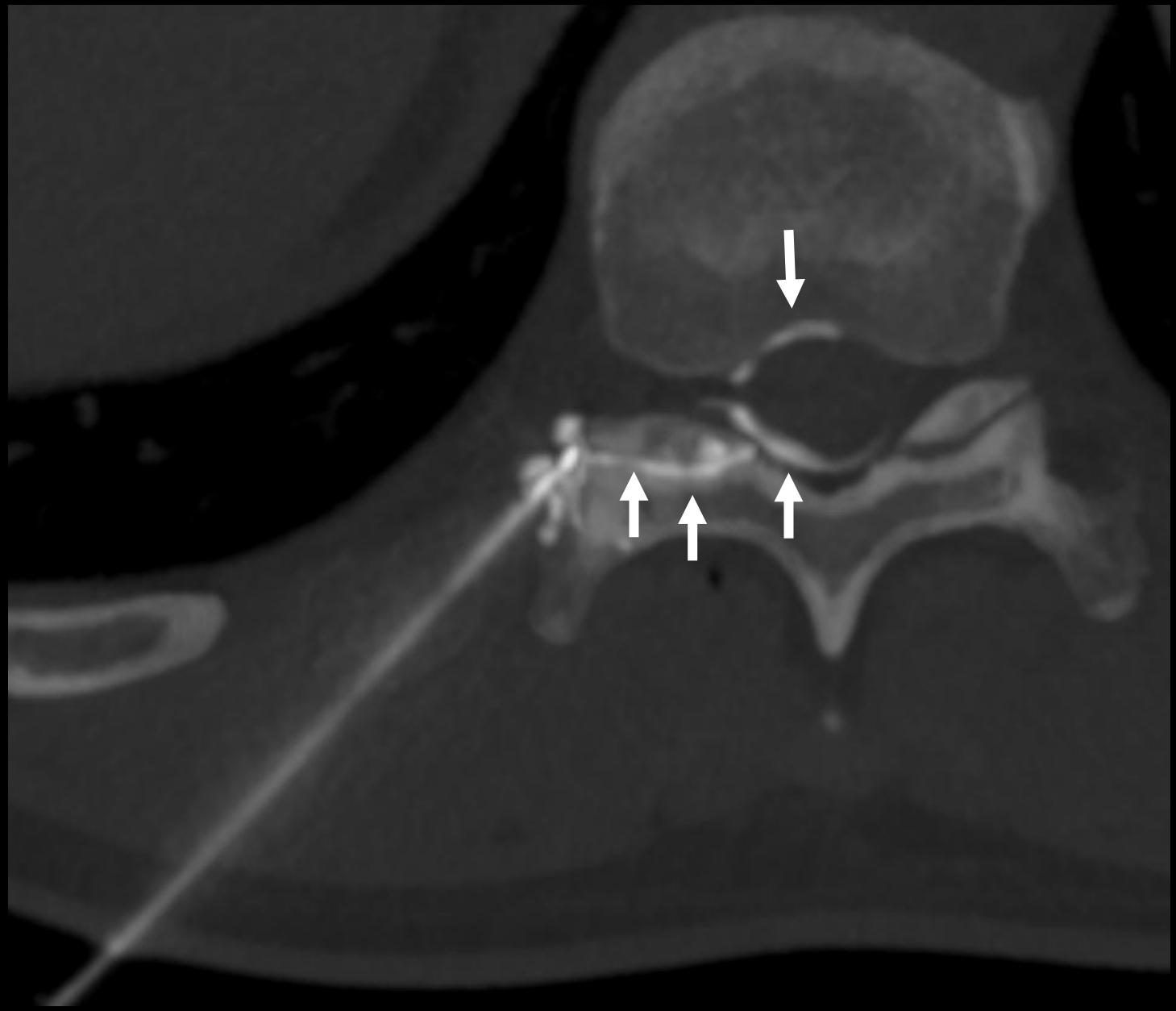
But why do leaks into facet joints matter?

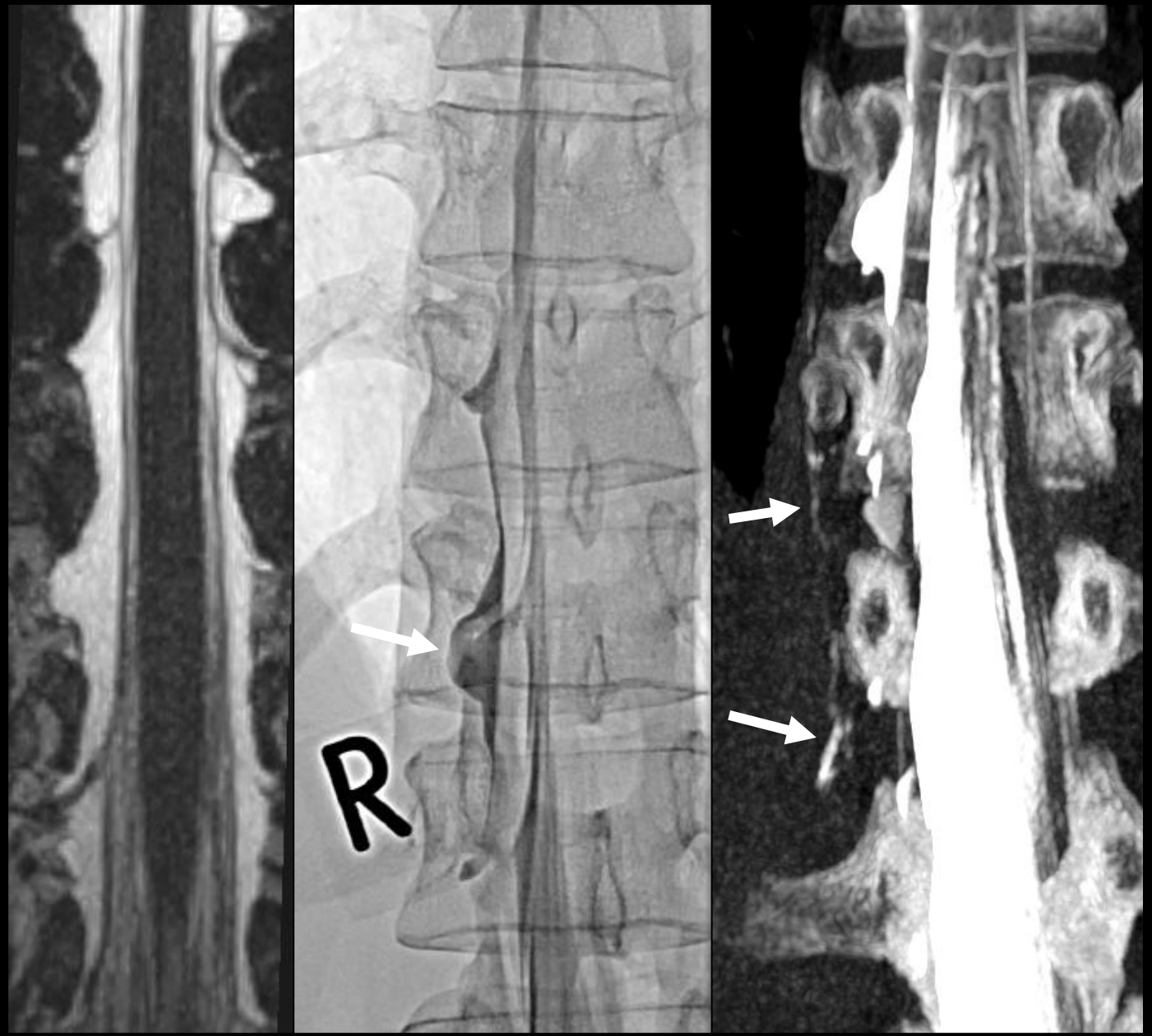
- Indicates chronic leak
- May improve detection of leaks on MRI
- Potentially facilitates epidural blood / fibrin patching

Atypical Imaging Manifestations of Lateral Dural Tears with Arachnoid Herniations: A Multi-Institutional Study

Ajay A. Madhavan, Michelle L. Kodet, Lalani Carlton Jones, Federico Cagnazzo, Jurgen Beck and Niklas Lutzen

American Journal of Neuroradiology October 2025, ajnr.A9071; DOI: https://doi.org/10.3174/ajnr.A9071

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Teaching point: arachnoid herniations can be associated with a secondary CSF-venous fistula

Treatment options for lateral tears?

- Nontargeted blood patch (early)
- Surgery
- Blood patch / fibrin injection

AJNR Am J Neuroradiol. 2025 Jul 3:ajnr.A8886. doi: 10.3174/ajnr.A8886. Online ahead of print.

Outcomes of CT-Guided Targeted Epidural Patching For Lateral Dural Tears In Spontaneous Intracranial Hypotension: A Multicenter Retrospective Cohort Study

Andrew L Callen [1], Daniel Montes [1], Debayan Bhaumik [1], Peter Lennarson [1], Mark D Mamlouk [1], Niklas Lützen [1], Jürgen Beck [1], Horst Urbach [1], Daniel Scoffings [1], David Butteriss [1], Lalani Carlton Jones [1]

Results: Fifty-six patients (mean age 38.7 ± 11.7 years; 80% female) were included. Mean pretreatment Bern score was 6.6 ± 2.3; no patients had superficial siderosis. Clinical resolution occurred in 20/56 (35.7%), and SLEC resolution in 10/40 (25%) on post-patch spine MRI. A herniated arachnoid pouch was present in 69.7% and associated with lower SLEC resolution (30% vs. 80%, p=0.003). Patch type, volume, transforaminal approach, and needle placement into the herniated pouch were not associated with outcomes. Post-patch Bern scores were lower among those with clinical resolution (0.9 ± 1.1 vs. 2.6 ± 2.5, p=0.046). Of 11 patients with complete clinical improvement who had post-patch spine MRI, 5 (45.5%) had persistent SLECs.

Summary

- Lateral dural tears can occur at the axilla or shoulder of the nerve root sleeve, or near the pedicle
- Lateral dural tears are often associated with a herniated arachnoid diverticulum
- MRI does not always reveal an epidural fluid collection
- Lateral dural tears are not always “fast” leaks
- Features that can accompany lateral dural tears
  - Leaks into the facet joint (potentially useful for diagnosis/treatment)
  - Secondary CSF-venous fistula

Thanks!

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