Dynamic CT myelography vs DSM

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Cedars Sinai Medical Center

Cedars Sinai

Outline

Background

How we do it

DSM in different leak types

Challenges / solutions

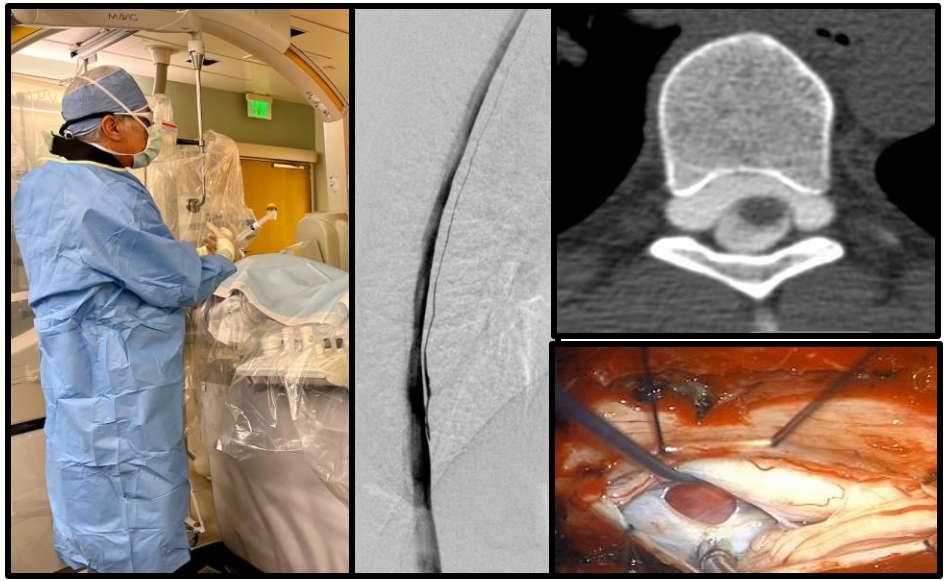
Cedars Sinai Experience

Jan 2001 - Jan 2025

> 3500 patients evaluated for “CSF leak”

2136 patients met ICHD-3 criteria

3788 DSMs performed to date



JAMA Neurology Meta Review*

DSM

highest sensitivity for identifying the leak site

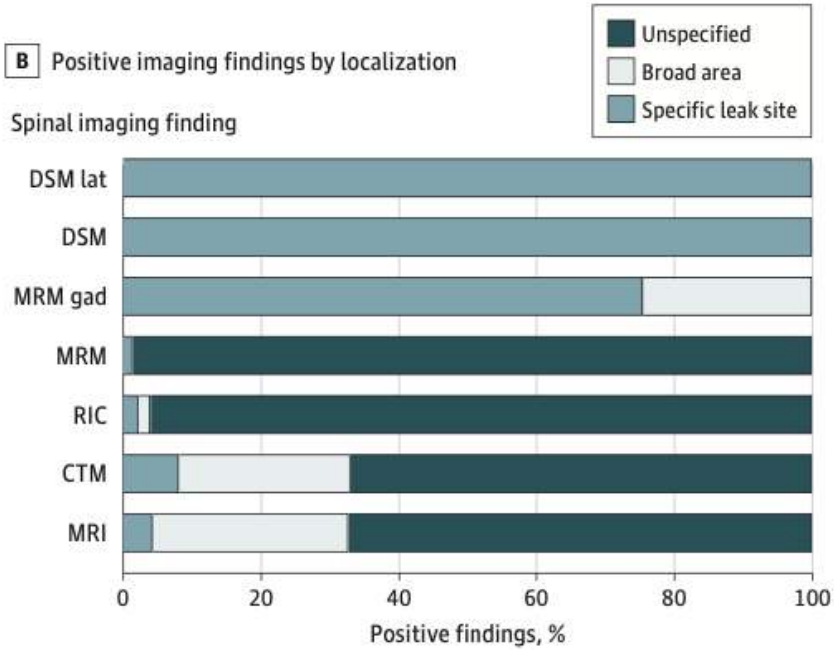
MR Myelogram (T2WI)

sensitive for presence of leak

not specific for exact site

Only one direct comparison study**

higher yield for CTM in study cohort



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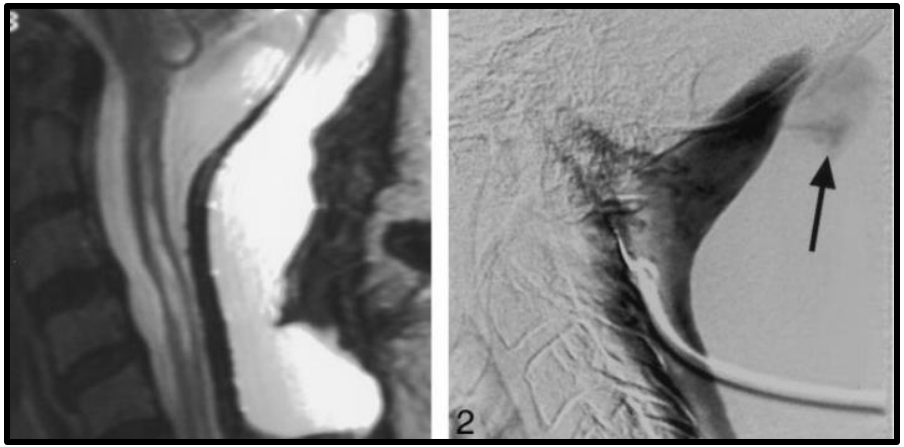
* D'Antona et al. JAMA Neurol 2021

** Lutzen et al. J Neurointerv Surg 2023

DSM Timeline

2002 Phillips et al AJNR

Depiction of a Postoperative Pseudomeningocele with DSM

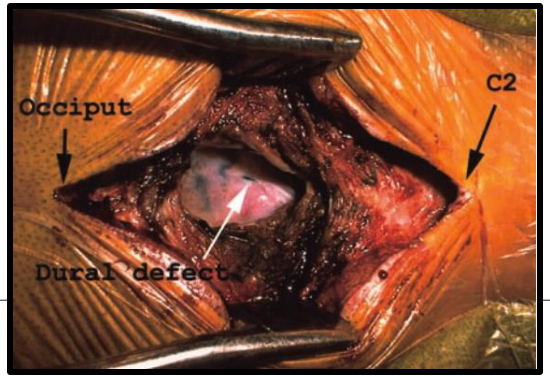


AJNR Am J Neuroradiol 23:337–338, February 2002

Case Report

Depiction of a Postoperative Pseudomeningocele with Digital Subtraction Myelography

C. Douglas Phillips, George J. Kaptain, and Nasser Razack



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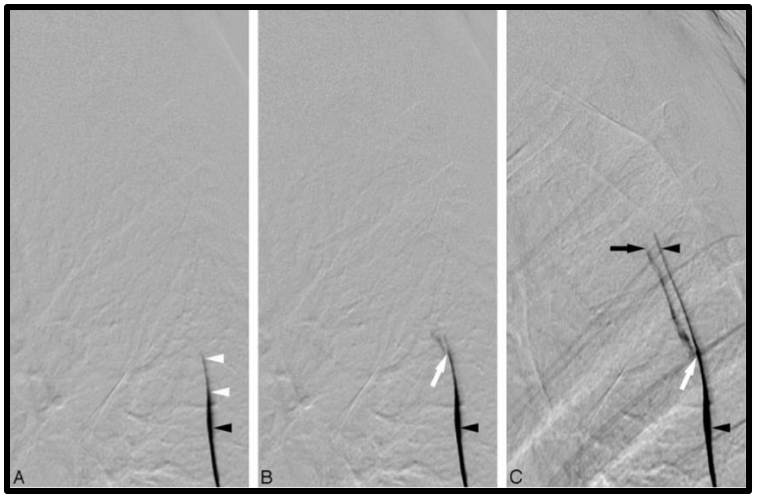
DSM Timeline

2009 Hoxworth et al AJNR

Localization of a Rapid CSF Leak with Digital Subtraction Myelography



CASE REPORT

J.M. Hoxworth
A.C. Patel
E.P. Bosch
K.D. Nelson

Localization of a Rapid CSF Leak with Digital Subtraction Myelography

SUMMARY: A 53-year-old woman with superficial siderosis underwent spinal MR imagir demonstrated a large cervicothoracic epidural fluid collection compatible with a CSF leak. Cor and dynamic CT myelography failed to localize the dural tear because of rapid equilib myelographic contrast between the thecal sac and the extradural collection. The superior resolution of digital subtraction myelography precisely localized the CSF leak preoperatively a the successful surgical correction of the dural tear.

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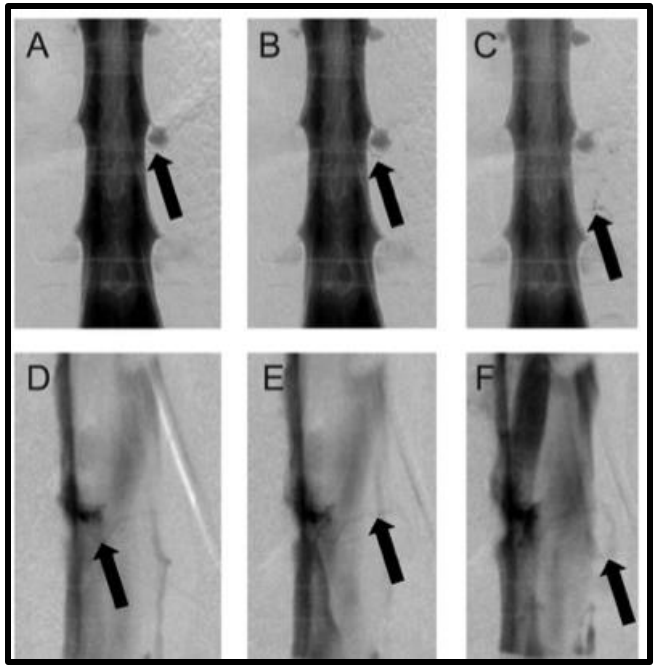
DSM Timeline

2009 First DSM @Cedars

2013 Discovery of CSF–venous fistula in spontaneous intracranial hypotension

(January 3rd, 2013)



Neurology®

July 29, 2014; 83 (5) CLINICAL/SCIENTIFIC NOTES

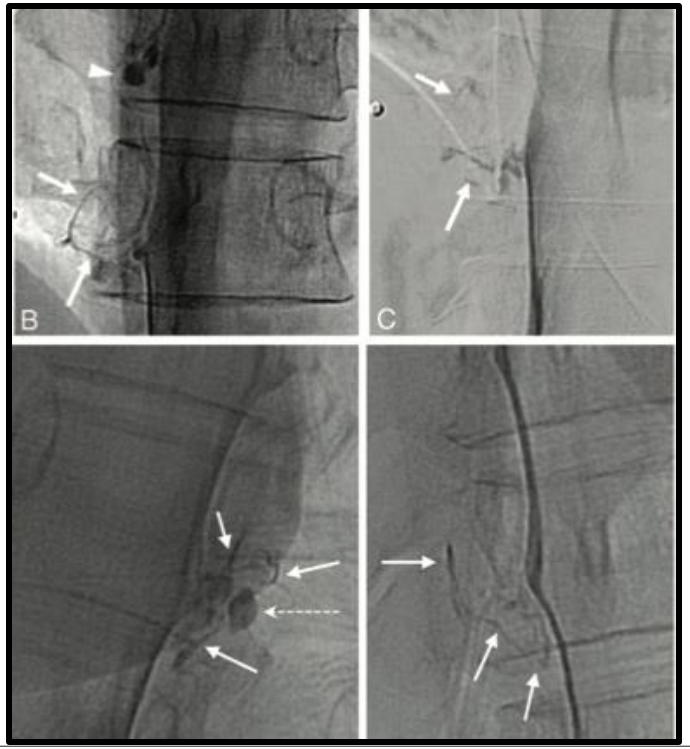
CSF–venous fistula in spontaneous intracranial hypotension

Wouter I. Schievink, Franklin G. Moser, M. Marcel Maya

DSM Timeline

2018 Farb advanced Lateral Decubitus

DSM for improved fistula detection



Spontaneous Intracranial Hypotension: A Systematic Imaging Approach for CSF Leak Localization and Management Based on MRI and Digital Subtraction Myelography

R.I. Farb, P.J. Nicholson, P.W. Peng, E.M. Massicotte, C. Lay, T. Krings, and K.G. terBrugge

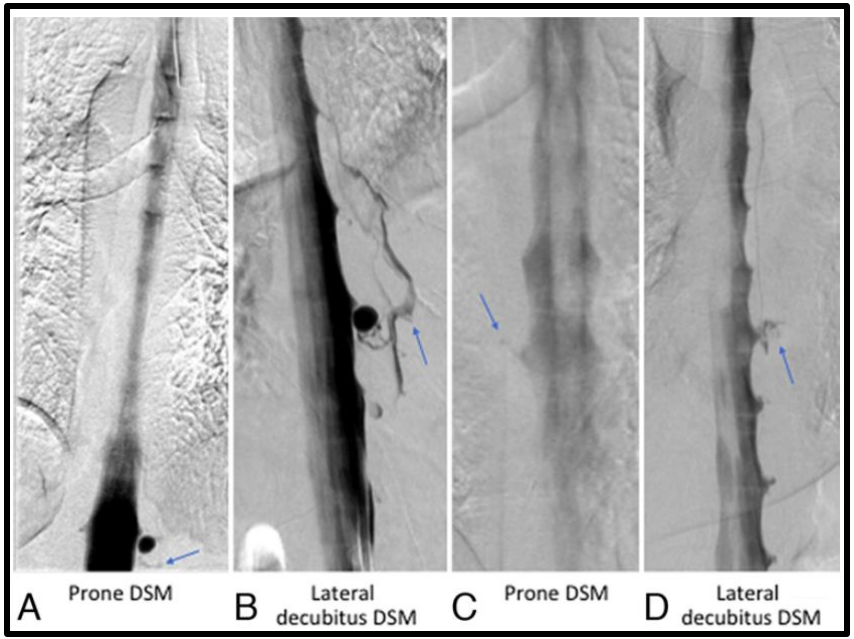
DSM Timeline

2019 Cedars JNS paper

Lateral DSM increased CSF–venous fistula yield from **15% to 75%**

Lateral decubitus digital subtraction myelography to identify spinal CSF–venous fistulas in spontaneous intracranial hypotension

Wouter I. Schievink, MD,[1] M. Marcel Maya, MD,[2] Franklin G. Moser, MD, MMM,[2] Ravi S. Prasad, MD,[2] Rachelle B. Cruz, MSN, APRN, NP-C,[1] Miriam Nuño, PhD,[3] and Richard I. Farb, MD, FRCPC[4]



Yield of DSM in CSF Venous Fistula

Positive brain MR	75%
Negative brain MR	10%
bv FTD	40%

JNS JOURNAL OF NEUROSURGERY
OFFICIAL JOURNALS OF THE AANS SINCE 1944

Home

Lateral decubitus digital subtraction myelography identify spinal CSF–venous fistulas in spontaneou intracranial hypotension

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Received: 26 March 2021 | Revised: 2 November 2022 | Accepted: 8 November 2022 | Published online: 14 December 2022
DOI: 10.1002/trc2.12367

RESEARCH ARTICLE

Translational Research & Clinical Interventions

The reversible impairment of behavioral variant frontotemporal brain sagging syndrome: Challenges and opportunities

Wouter I. Schievink[1] | Marcel Maya[2] | Zachary Barnard[1] | Rachelle B. Taché[1] | Ravi S. Prasad[2] | Vikram S. Wadhwa[2] | Franklin G. Moser[2] | Miriam Nuño[3]

HEADACHE
The Journal of Head and Face Pain

PERSPECTIVES

Spontaneous spinal cerebrospinal fluid-venous fistulas in patients with orthostatic headaches and normal conventional brain and spine imaging

Wouter I. Schievink MD, Marcel Maya MD, Ravi S. Prasad MD, Vikram S. Wadhwa MD, Rachelle B. Cruz MSN, APRN, NP-C, Franklin G. Moser MD, MMM, Miriam Nuno PhD

First published: 23 January 2021 | https://doi.org/10.1111/head.14048 | Citations: 13

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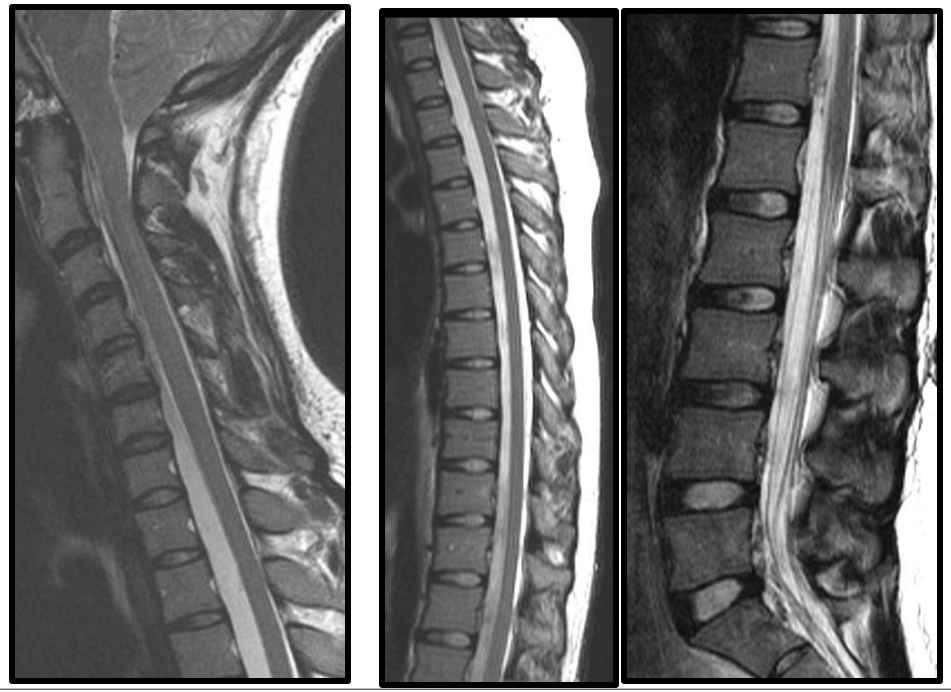
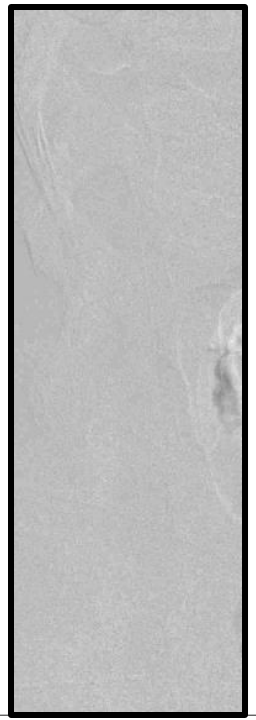
DSM Ventral leak

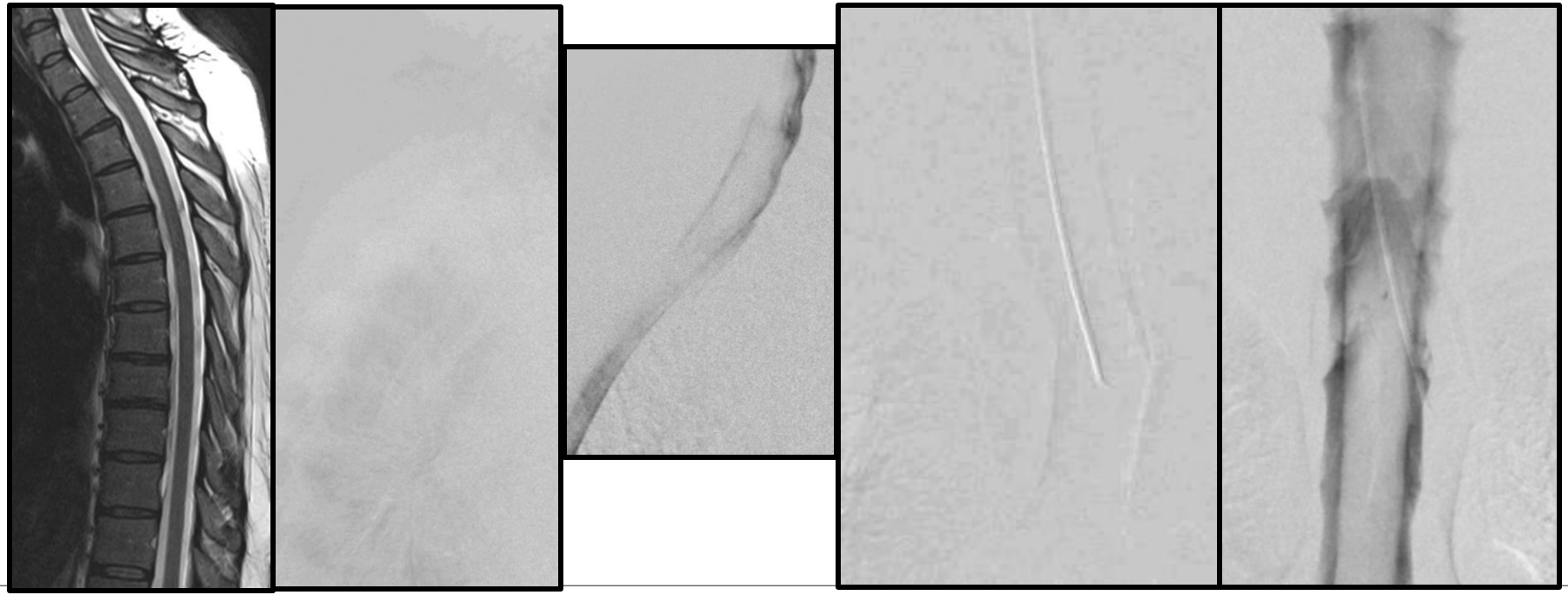
31 year-old woman with SIH





DSM Ventral Leak Kyphosis

36 year-old woman SIH with ventral leak



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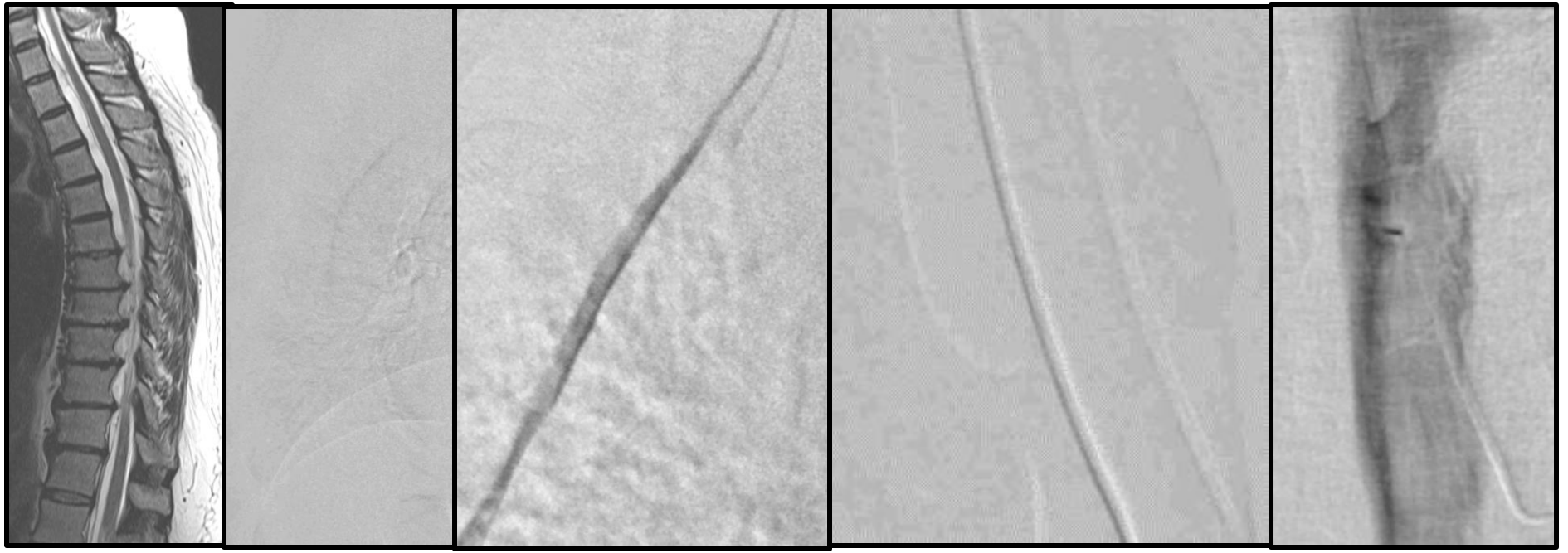
DSM Ventral Leak wrong level

56-year-old woman ventral leak persistent leak after surgery



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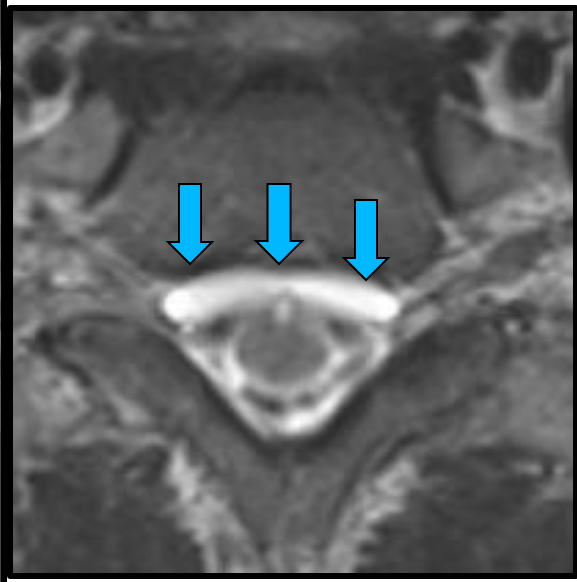
DSM Ventral Leak Shoulder Problem

53 year-old man headache, diplopia, ear symptoms with cognitive and personality changes

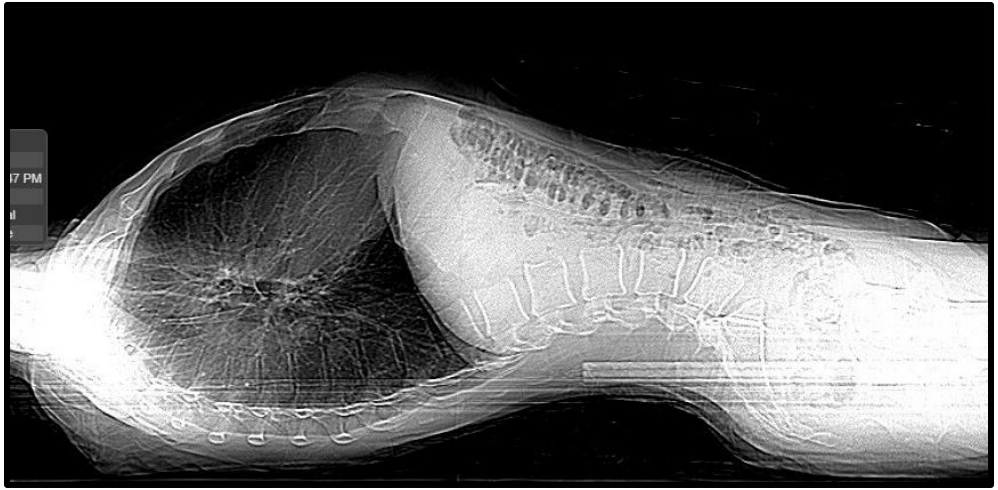
MR brain negative
MR spine long ventral collection C6-T11



DSM Ventral Shoulder Problem

53 year-old man headache, diplopia, ear symptoms with cognitive and personality changes

Exaggerated
Lumbar lordosis
Thoracic kyphosis



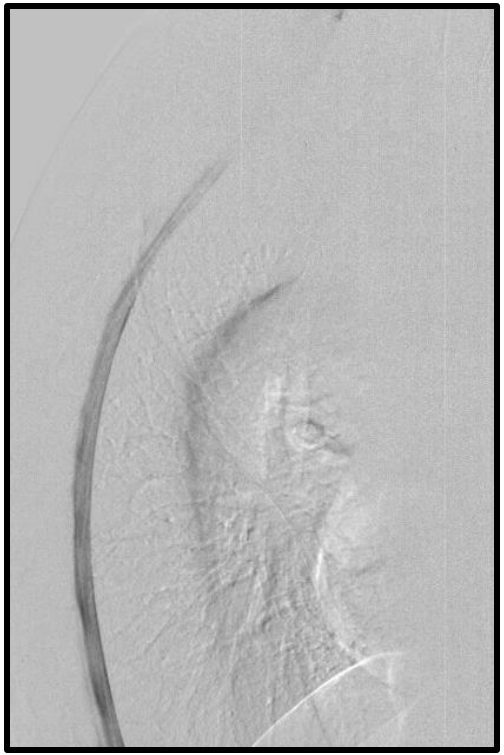
DSM Ventral Leak Shoulder Problem

53 year-old man headache, diplopia, ear symptoms with cognitive and personality changes

Problems

- **coverage**
- **severe tilt**
- **shoulders**

DSM T11 to C7



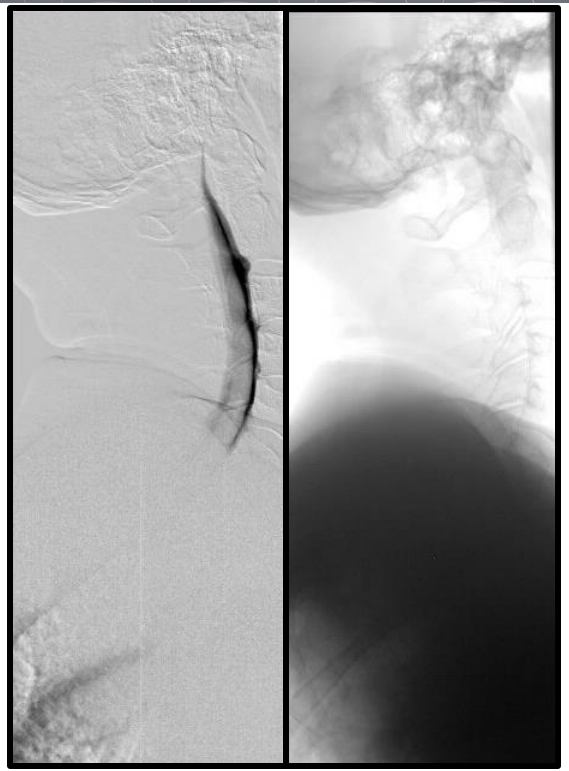
DSM Ventral Leak Shoulder Problem

53 year-old man headache, diplopia, ear symptoms with cognitive and personality changes

Problems

- **coverage**
- **severe tilt**
- **shoulders**

DSM2 skull base to upper thoracic



DSM Ventral Leak Shoulder Problem

53 year-old man headache, diplopia, ear symptoms with cognitive and personality changes

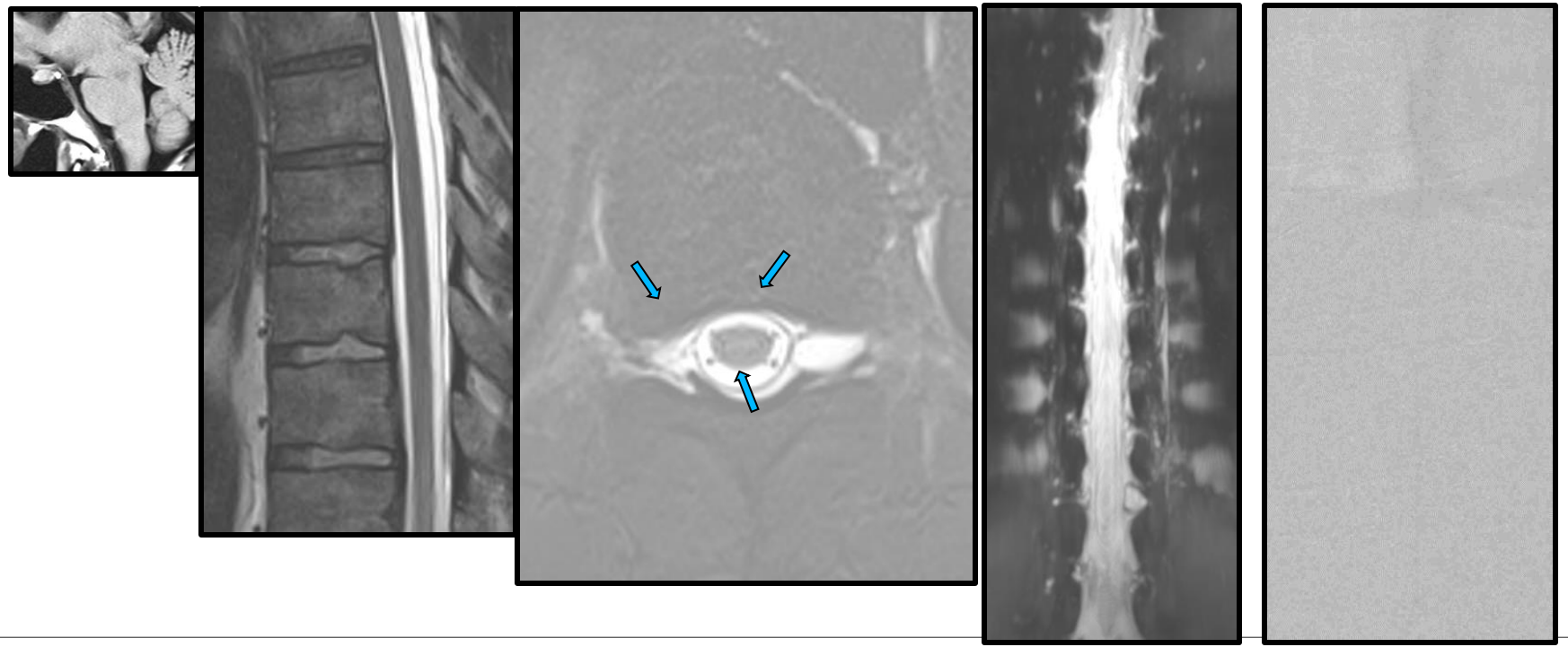
Problems

- coverage
- severe tilt
- shoulders

CT Myelo saves the day

DSM Lateral Leak

37-year-old man s/p cervical ADR with postoperative headaches



Lateral leak variants

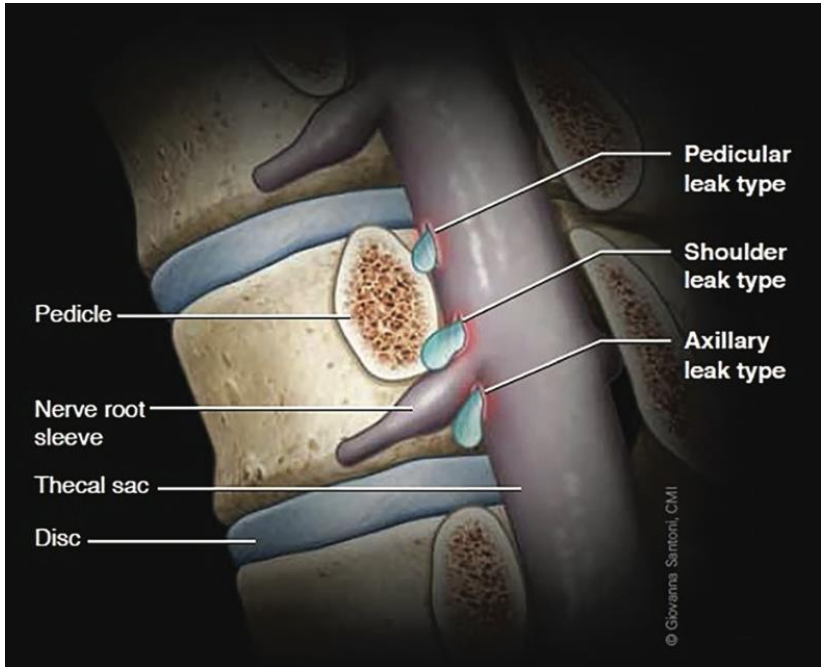
53 pt with lateral leaks

49 pt (92.5%) nerve root sleeve tears

- 36 patients (67.9%) at axilla
- 13 patients (24.5%) at shoulder
- (all extradural collections)

4 pt (7.5%) tear at the level of the pedicle

- (2/4 no extradural collections)



Lateral Spinal CSF Leaks in Patients with Spontaneous Intracranial Hypotension: Radiologic-Anatomic Study of Different Variants

Wouter I. Schievink, Marcel M. Maya, Angelique Sao-Mai S. Tay, Rachelle B. Taché, Ravi S. Prasad, Vikram Wadhwa, and Miriam Nuño

Lateral leak without extradural fluid collections

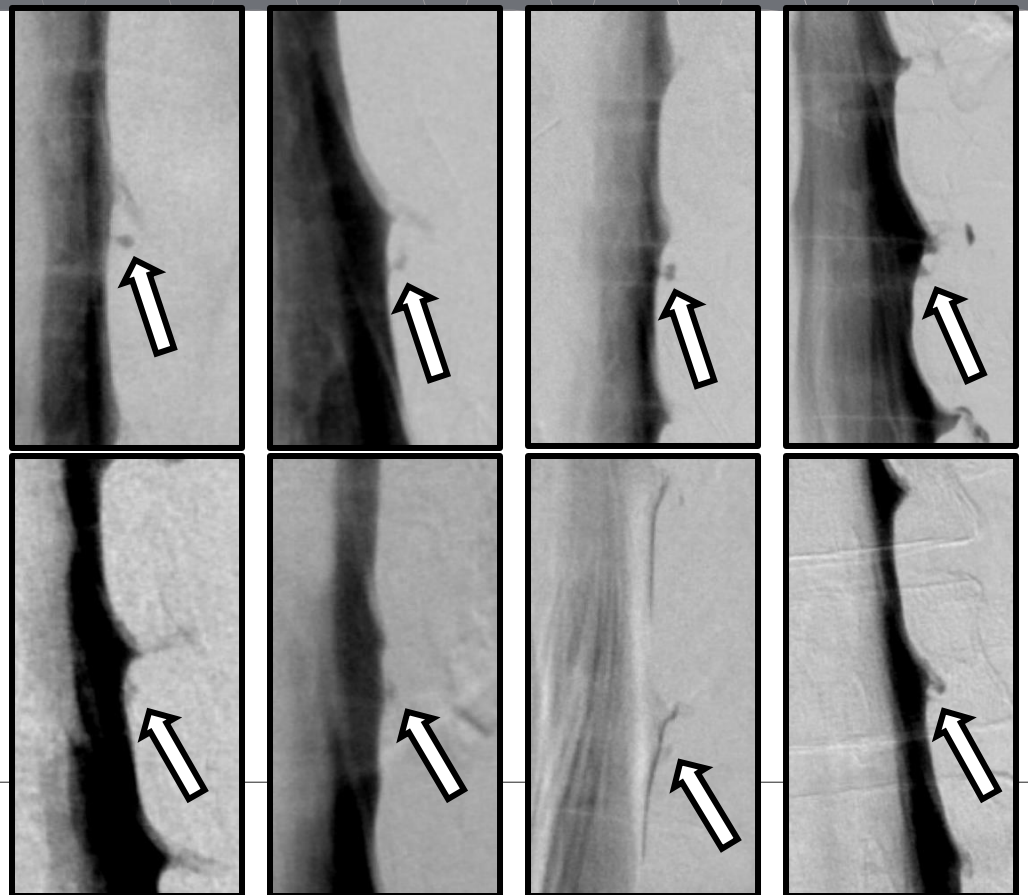
No obvious CVF or SLEC

Not associated with nerve root sleeve

Most leaks in lower thoracic spine

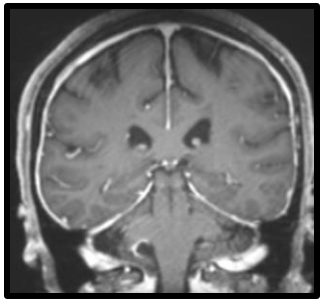
Most leaks small dural tears

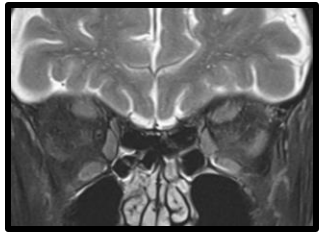
Either CVF or small tear- hard to tell



DSM fistula

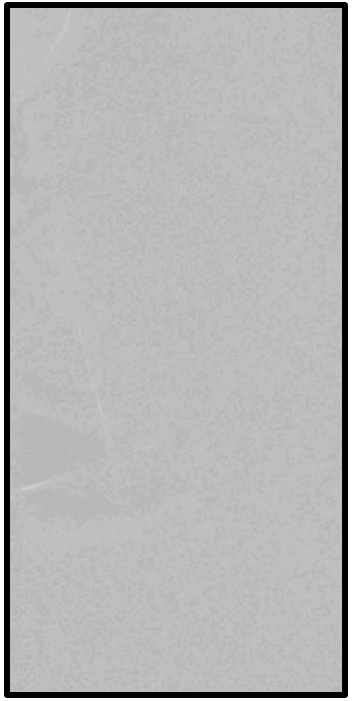
82-year-old woman with confusion, dizziness headaches 6 months

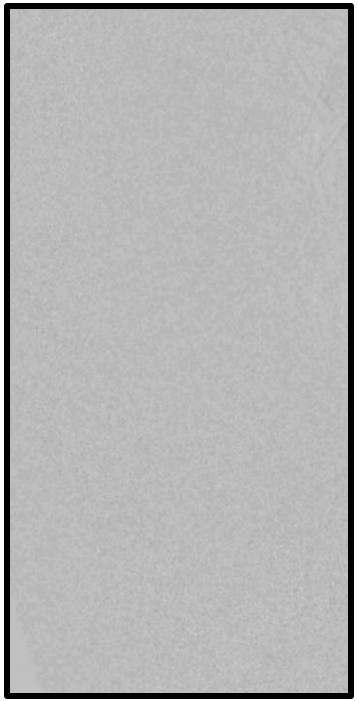




Fistula visualized within 2 seconds of contrast arrival

"CSF-venous fistula appeared 9.1 seconds (range, 0-30 seconds) after contrast reached the spinal level"





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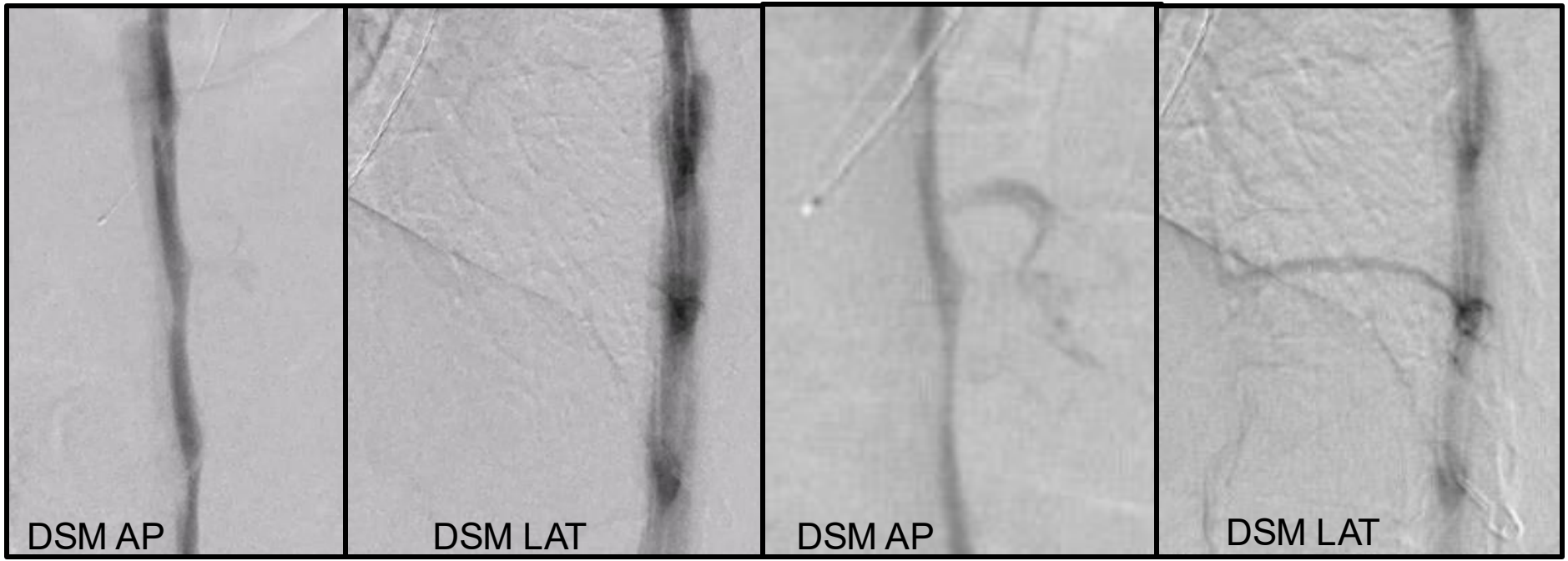
Temporal Characteristics of CSF-Venous Fistulas on Digital Subtraction Myelography

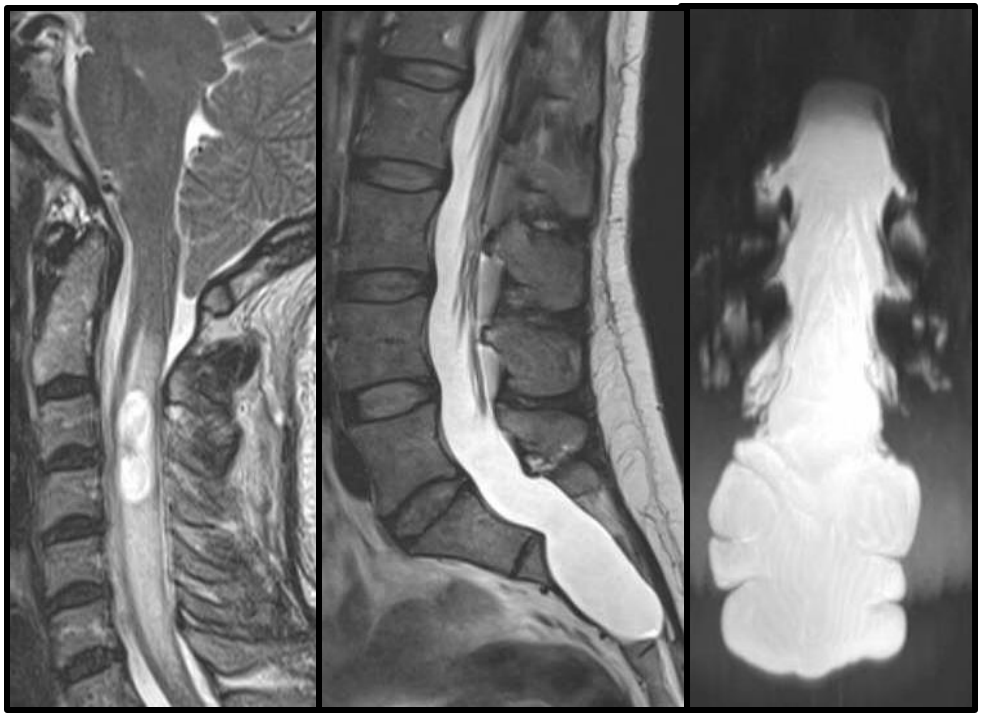
I Mark [a,✉], A Madhavan [a], M Oien [a], J Verdoorn [a], JC Benson [a], J Cutsforth-Gregory [b], W Brinjikji [a], P Morris [a]

DSM fistula (check lateral)



DSM CSF Venous Fistula Sacrum

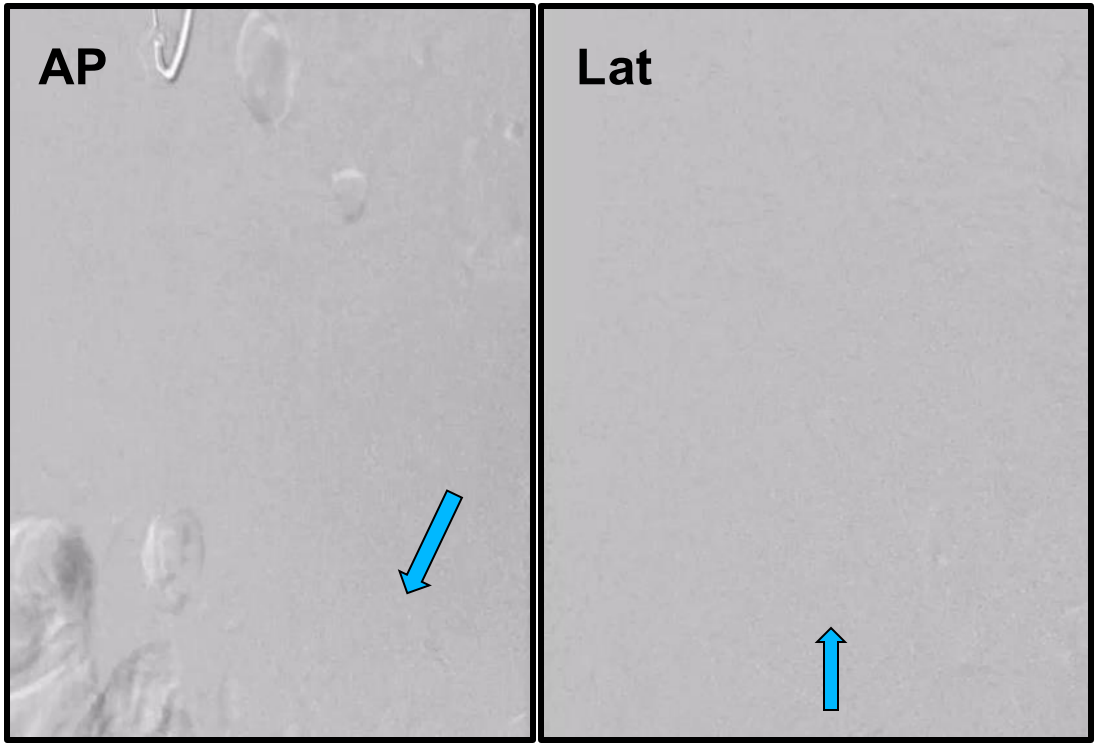
39-year-old woman with headaches for 7 years and recent BUE weakness



DSM CSF Venous Fistula Sacrum

39-year-old woman with headaches for 7 years and recent BUE weakness

DSM lateral decubitus



Cedars Sinai

Sacral Dural Tears as a Cause of Spontaneous Intracranial Hypotension

Niklas Lützen[1] · Enrique Barvulsky Aleman[1] · Amir El Rahal[2] · Florian Volz[2] · Christian Fung[2] · Jürgen Beck[2] · Horst Urbach[1]

DSM CSF Venous Fistula Sacrum

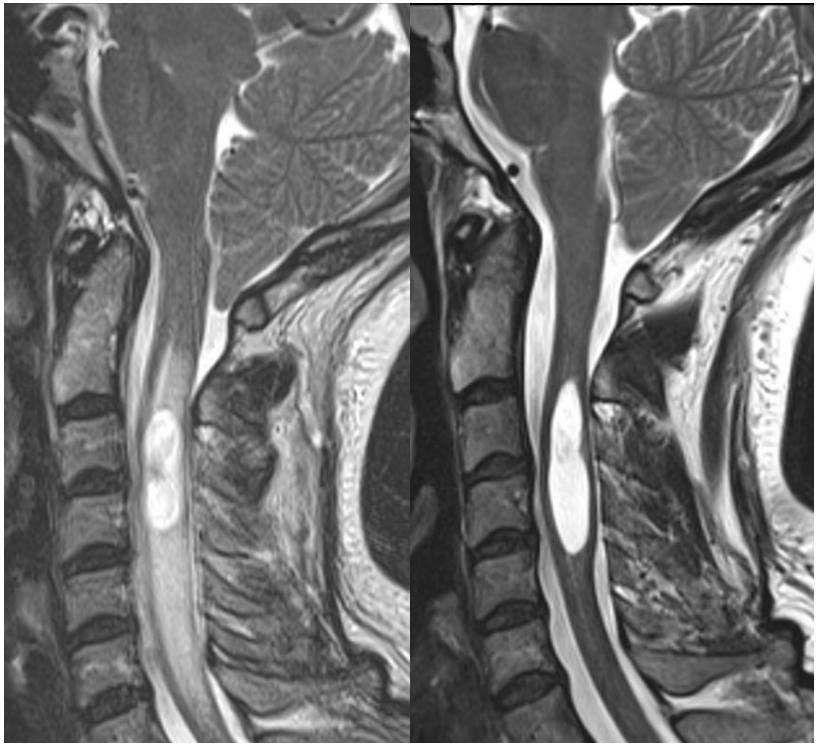
39-year-old woman with headaches for 7 years and recent BUE weakness

Fibrin glue and surgery

Brain sag resolved

Syrinx/edema smaller

Improved BUE strength

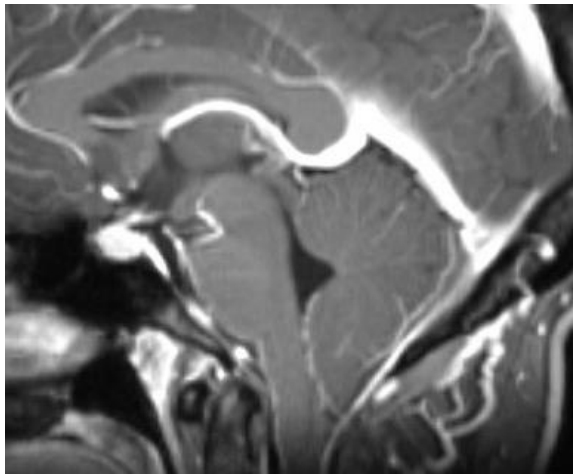


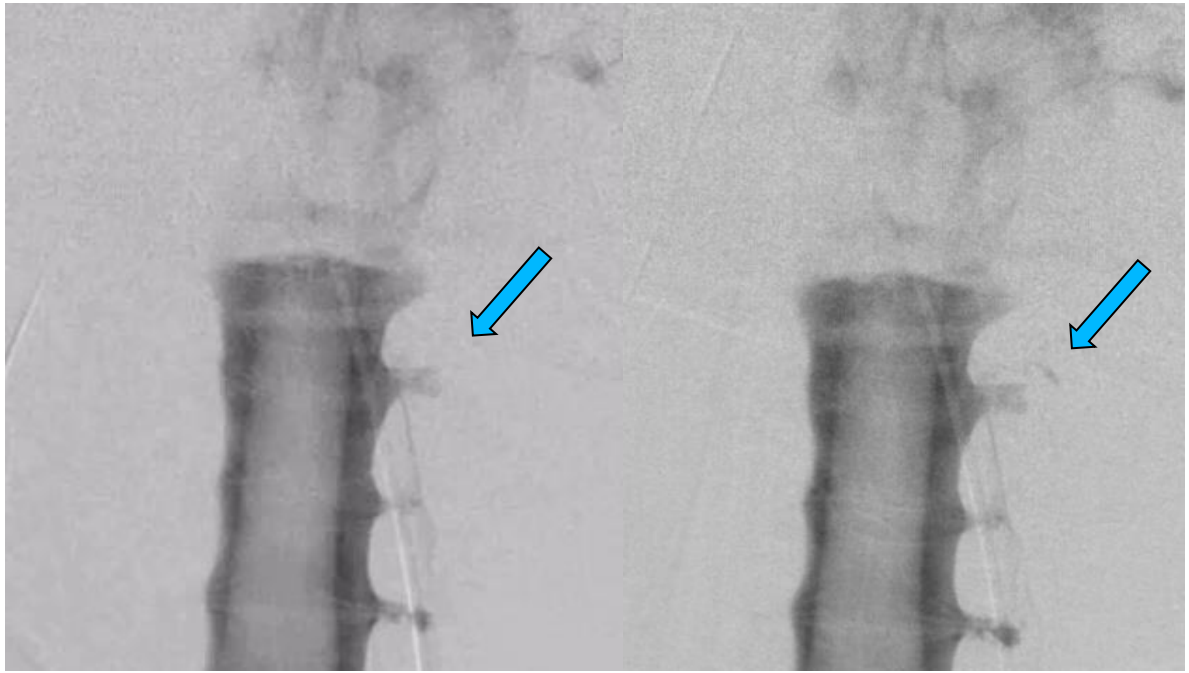
Pre procedure

Post procedure

DSM Fistula Cervical (C2)

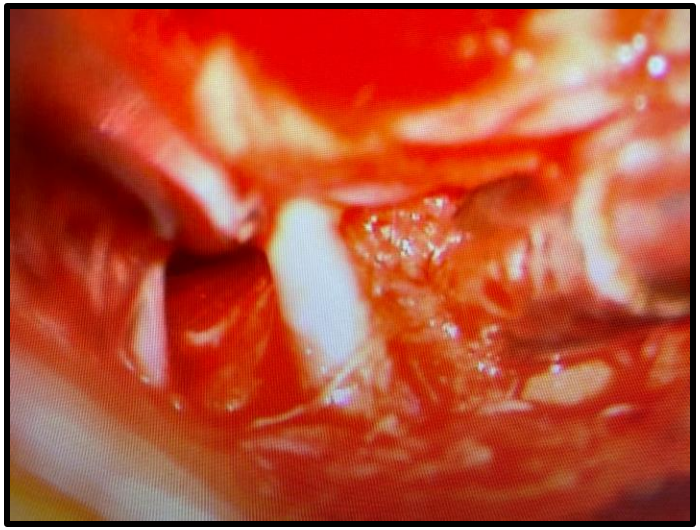
39-year-old woman headaches, tinnitus related to SIH

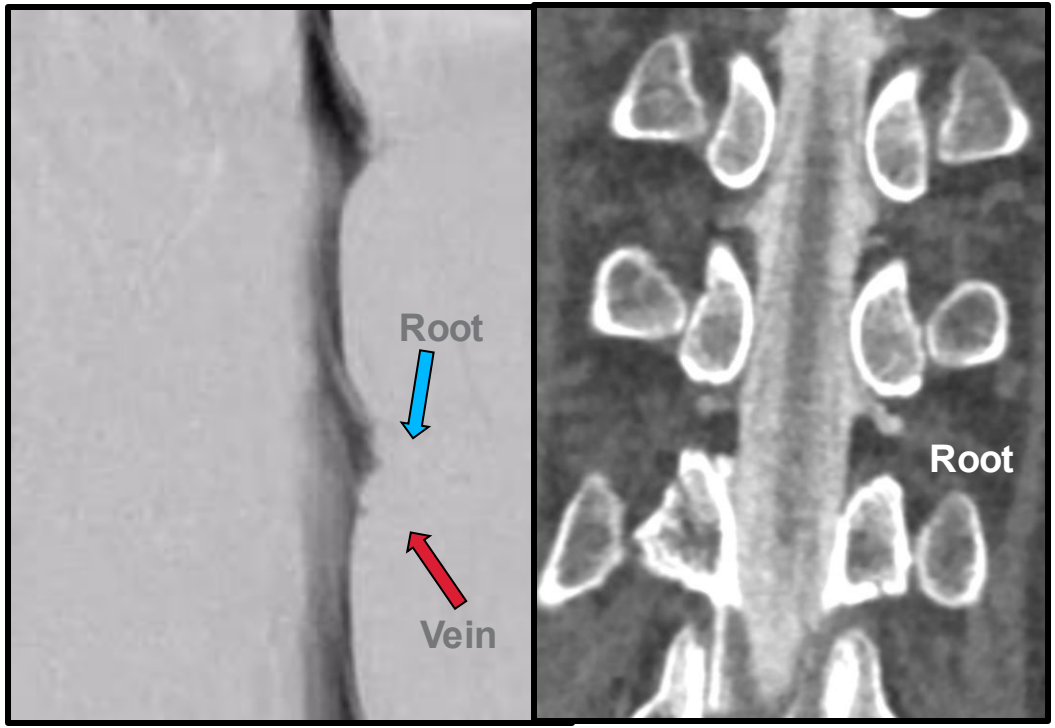




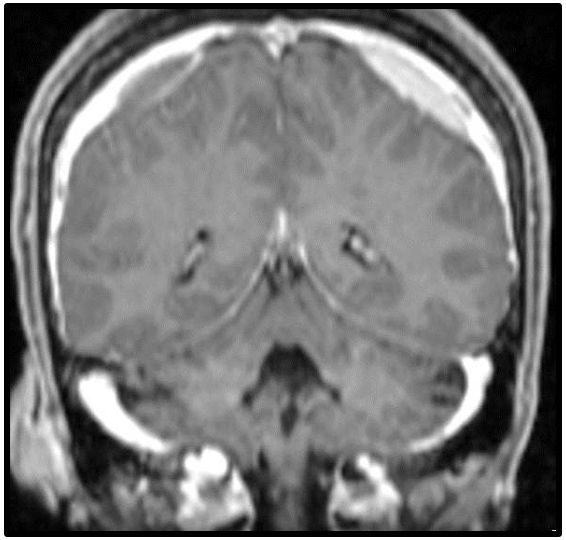
DSM subtle fistula

41 year-old man with headaches
SIH (16 months)
negative brain MR





DSM challenge fusion and stenosis



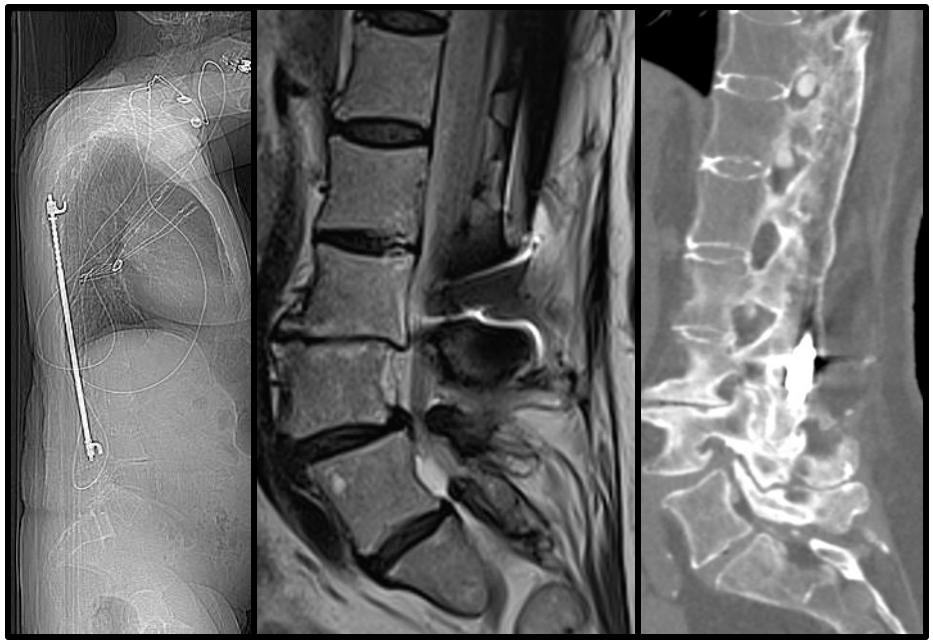
75-year-old woman positional headaches

She googled and diagnosed herself with SIH 24 hours after symptom onset and went to ED

CT brain bilateral SDH

MR brain SDH and SIH

DSM challenge fusion and stenosis



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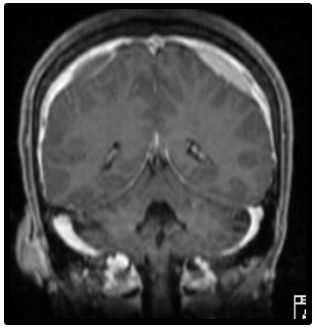
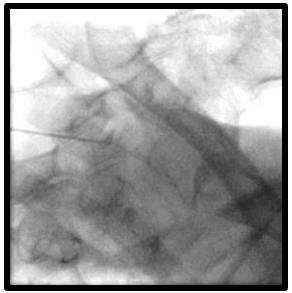
CT brain bilateral SDH

MR brain SDH and SIH

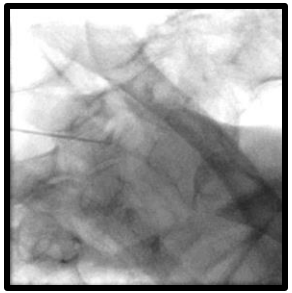


DSM challenge fusion and stenosis

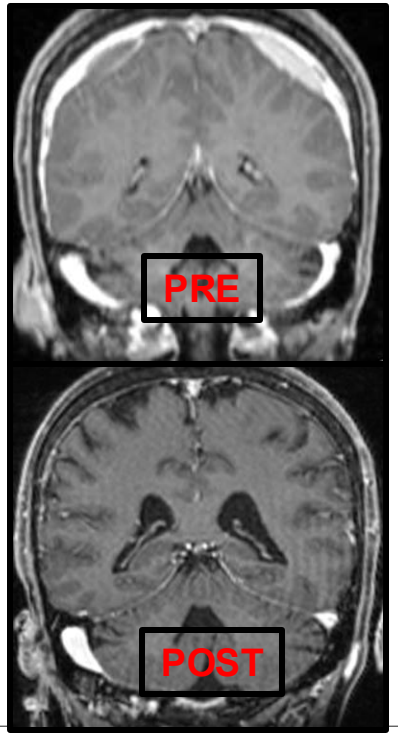


Puncture at C7-T1

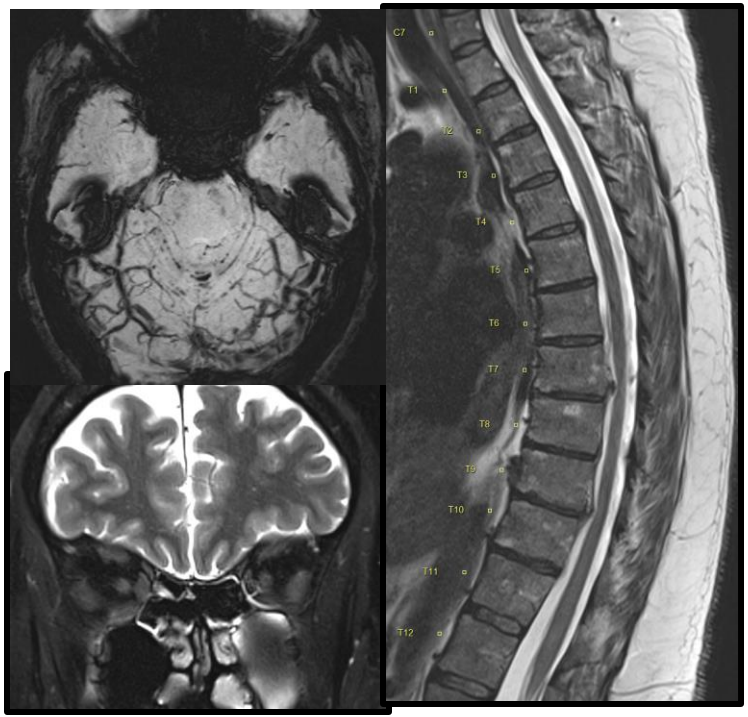
DSM challenge fusion and stenosis



Puncture at C7-T1



DSM level discrepancy with DCTM



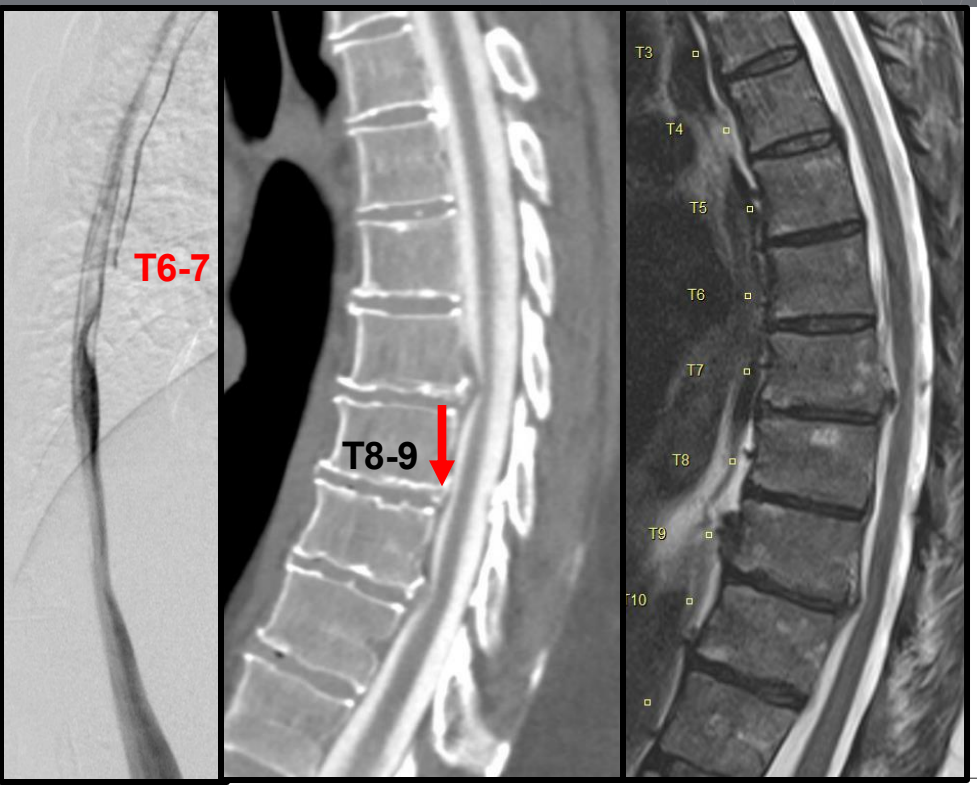
47-year-old woman h/o of MS ventral CSF leak discovered incidentally when undergoing an MRI Cspine for MS

Migraine headaches otherwise asymptomatic

DCTM ventral dural tear T8-9 calcified disk

Referred to Cedars for surgery due to siderosis

DSM level discrepancy with DCTM



47-year-old woman h/o of MS ventral CSF leak discovered incidentally when undergoing an MRI C-spine for MS

Migraine headaches otherwise asymptomatic

DCTM ventral dural tear T8-9 calcified disk

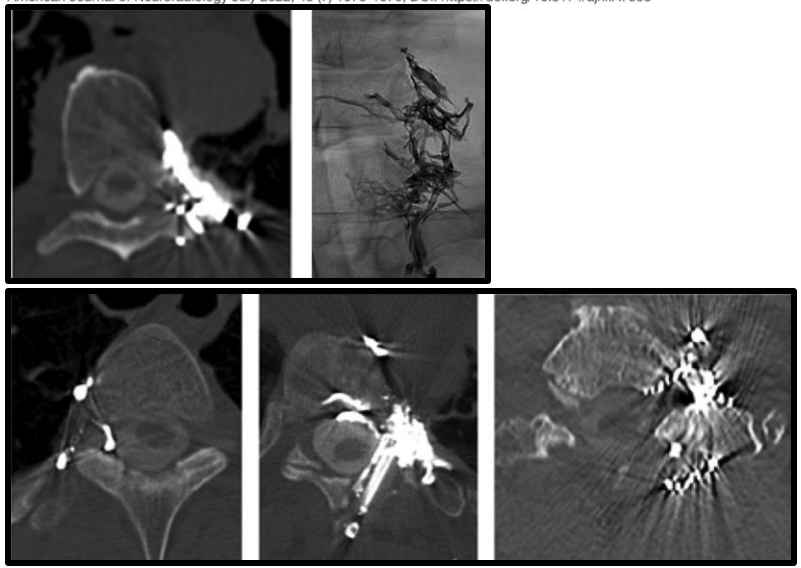
DSM **leak at T6-7**

Post embolization/clipping Imaging

Surgical Ligation of Spinal CSF-Venous Fistulas after Transvenous Embolization in Patients with Spontaneous Intracranial Hypotension

W.I. Schievink, R.B. Tache and M.M. Maya

American Journal of Neuroradiology July 2022, 43 (7) 1073-1076; DOI: https://doi.org/10.3174/ajnr.A7558

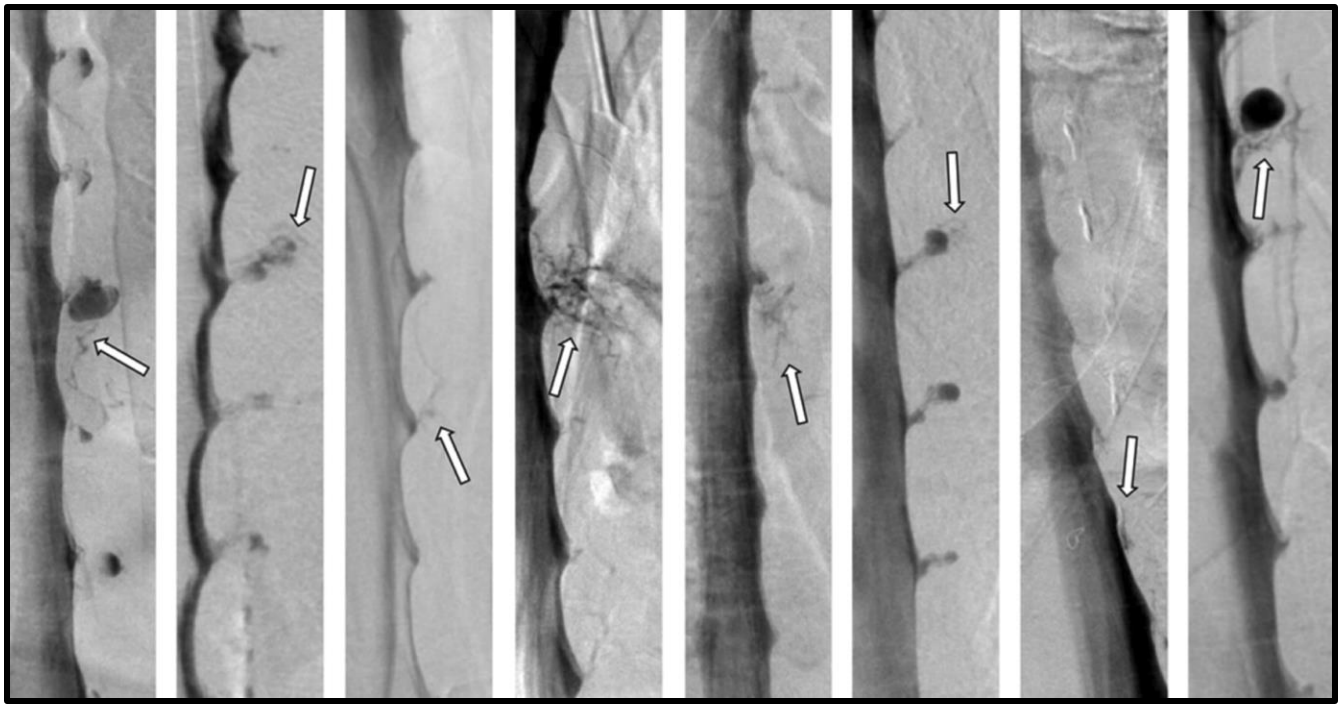


CT based techniques at a disadvantage due to streak artifacts

Newer embolic material with less artifact?

DSM

Post embolization/clipping Imaging



Cedars Sinai

Surgical Ligation of Spinal CSF-Venous Fistulas after Transvenous Embolization in Patients with Spontaneous Intracranial Hypotension

DSM

CHALLENGES

- Shoulder artifact (use AP)
- Kyphosis/lordosis (tilt table)
- Multiple days for CVF (two station)
- Subtle fistulas or tears

OPPORTUNITIES

- Precise and accurate levels
- Temporal resolution for CVF
- Post embo artifact less
- Radiation dose lower than DCTM
- Probably less operator dependent

DSM or DCTM

Both techniques proven effective in SIH diagnosis

Availability of equipment/time slots

Experience of the radiologist

Established practice patterns

DSM or DCTM

But for many people

This is a DEALBREAKER!

All hope is not lost

For Sale: One Red Tesla, Once Belonging to the President

The car, which President Trump acquired in March to show his support for Elon Musk, is one of the first tangible casualties of their shattered alliance.

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DSM for CSF Leak

- Sensitive and specific for leak site
- Accurate leak level localization
- Safe and well tolerated
- Rad dose compares well with other techniques

THANK YOU

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