How I do it: EBP



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Conflicts of interest

- Advisory Board Biogen, Lilly
- paid for lectures from Eisai, Biogen, Lilly, Mbits, GE, Bayer (2020-2024)
- Co-editor Clin Neuroradiol

EBP or fibrin patch : Possible indications

- PDPH
  - diagnostic lumbar puncture
  - therapeutic lumbar puncture: e.g. IIH
  - unintended dural puncture
    - PDA
    - spinal surgery
    - …..

- SIH
  - spinal CSF leak (type 1, 2 or 3)
  - spinal CSF leak not localized
    - low flow leak, sacral leaks
  - dural ectasia
  - no leak

  - spinal CSF leak from preexisting IIH

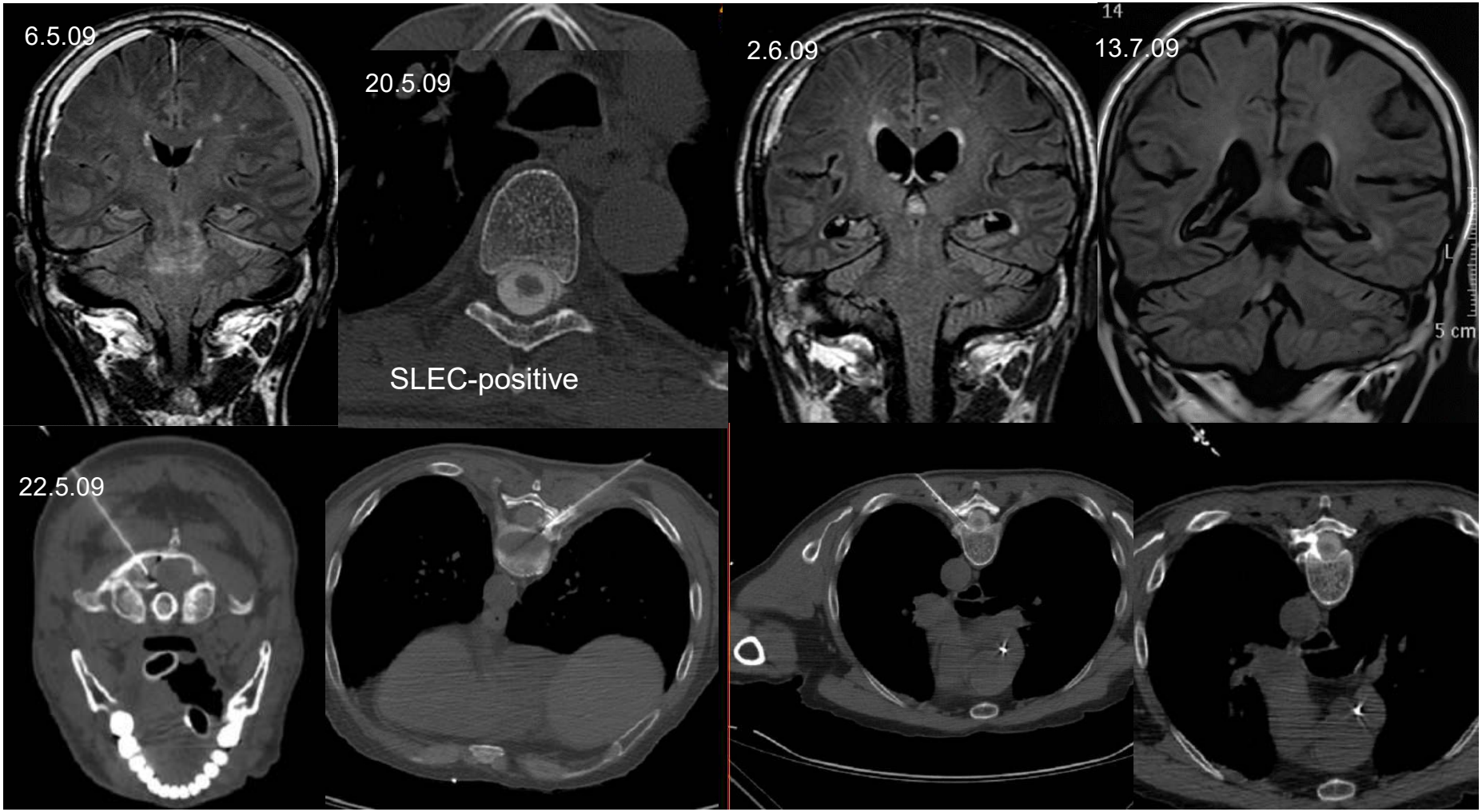
EBP or fibrin patch : Current indications

- How I did it: The pre „dynamic DSM - dynamic CTM“ era

2017

- How and when I do it now:
  - PDPH
    - with spinal CSF leaks
    - without spinal CSF leaks
  - Type 2 leaks
    - with rather small arachnoid herniations
  - (type 3 leaks)
  - Sacral leaks
  - bvFTBSS („spinal dementia“)

Head +, SLEC +: CT-guided multi-level epidural fibrin patch



C1/2 left, C2/3 right, Th5/6 left, Th 6/7 left, Th7/8 right

Non targeted Epidural Blood Patch: Head +, SLEC +

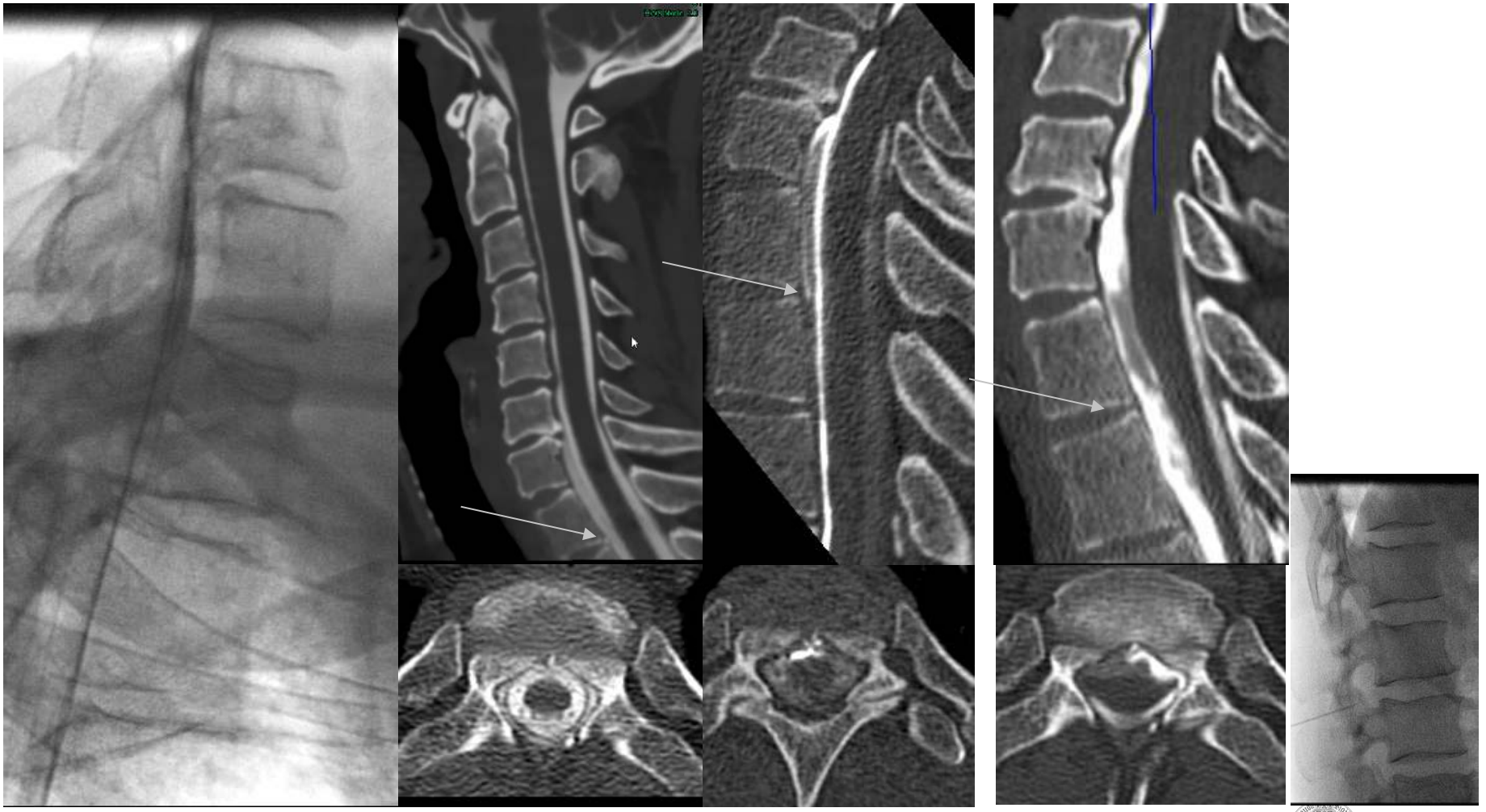


Non targeted Epidural Blood Patch: ventral leak Th1/2

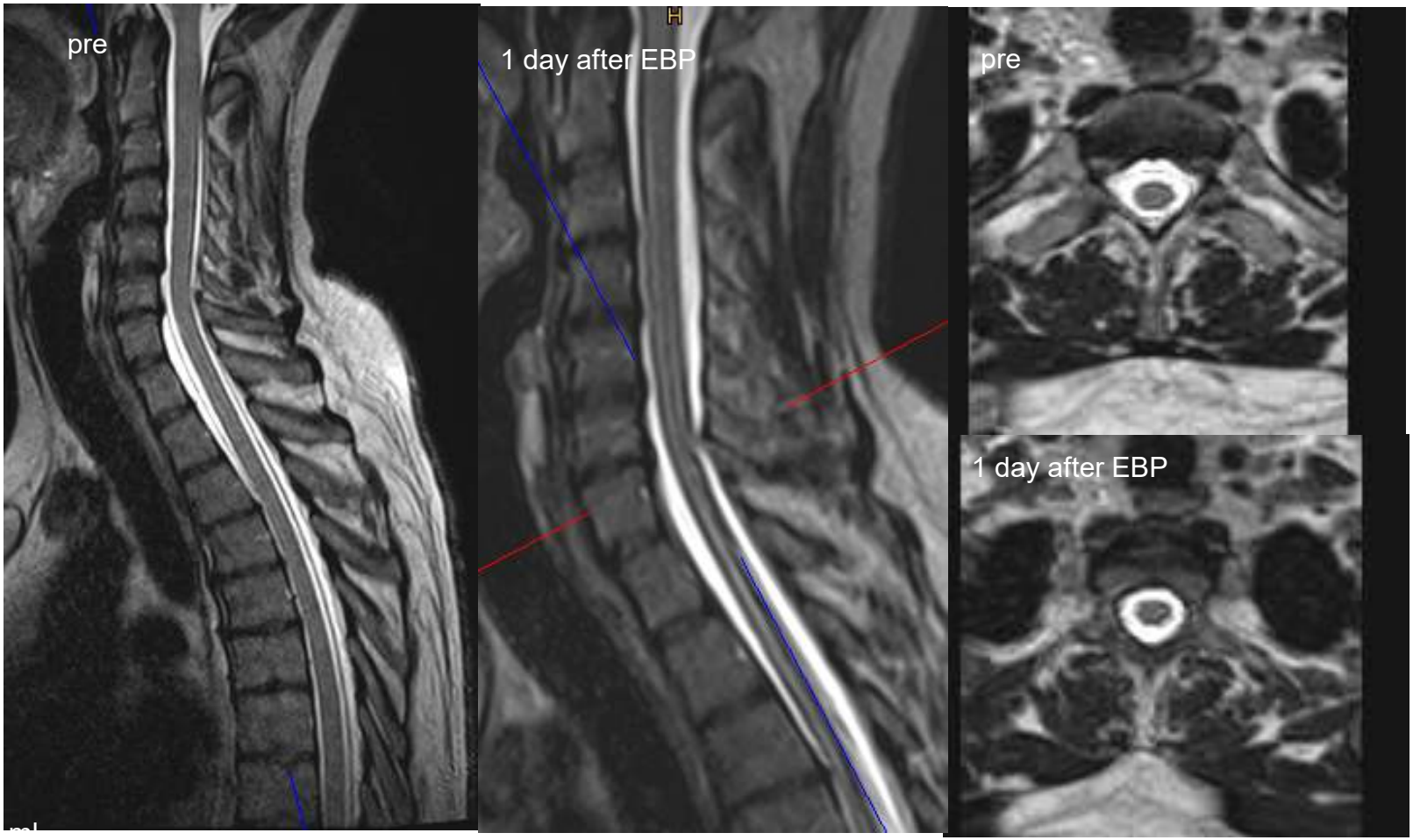
CT myelography

dynamic
CT myelography

non-targeted
EBP 50 ml



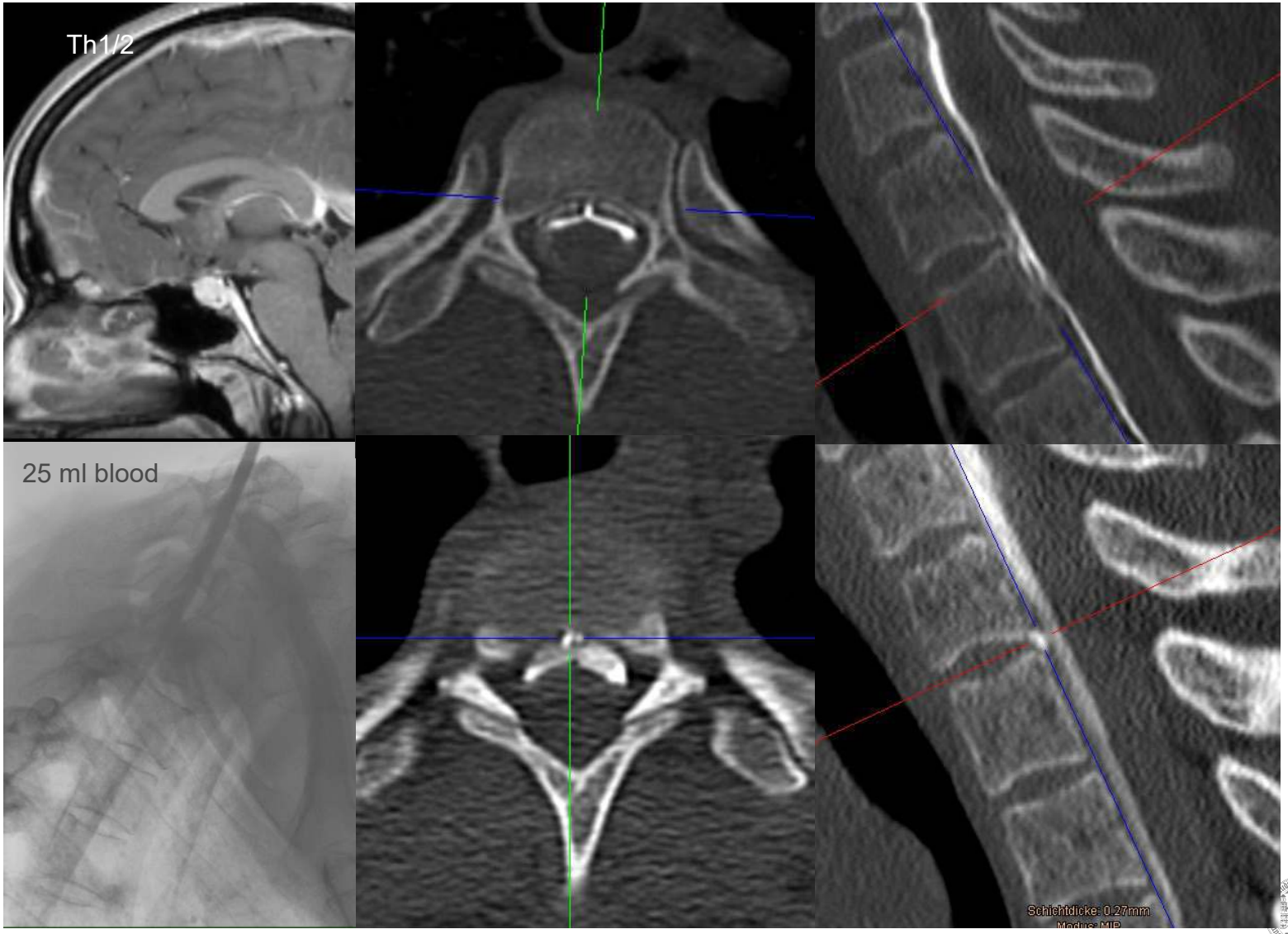
Non targeted Epidural Blood Patch: ventral leak Th1/2



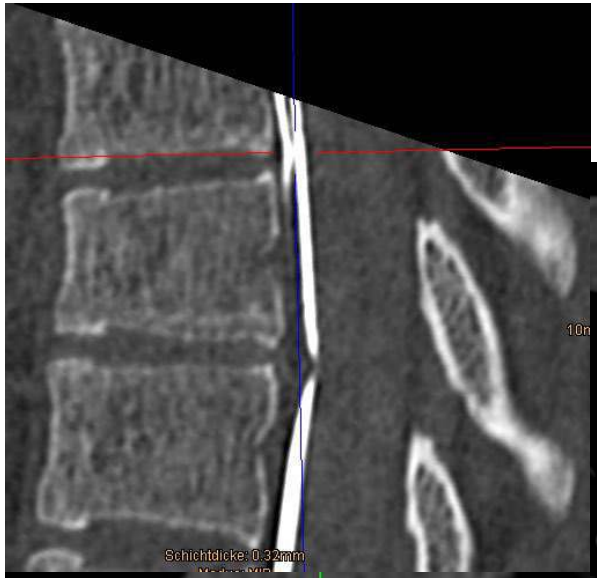
m, 50, after 1 day: No headache, persisting N.VI paresis

Non targeted Epidural Blood Patch: ventral leak Th1/2

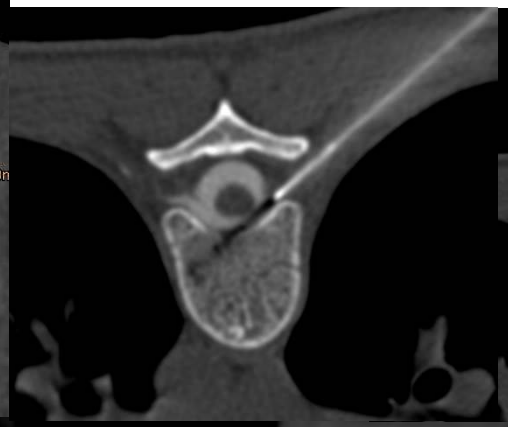
f, 29



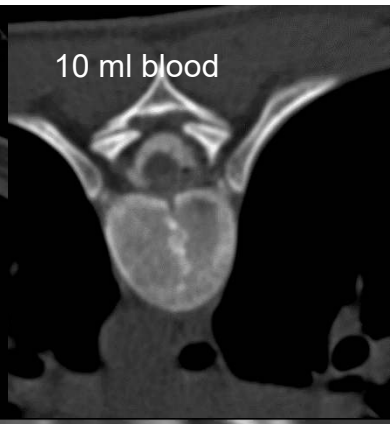
CT-guided targeted, „ventral“ Epidural Blood Patch

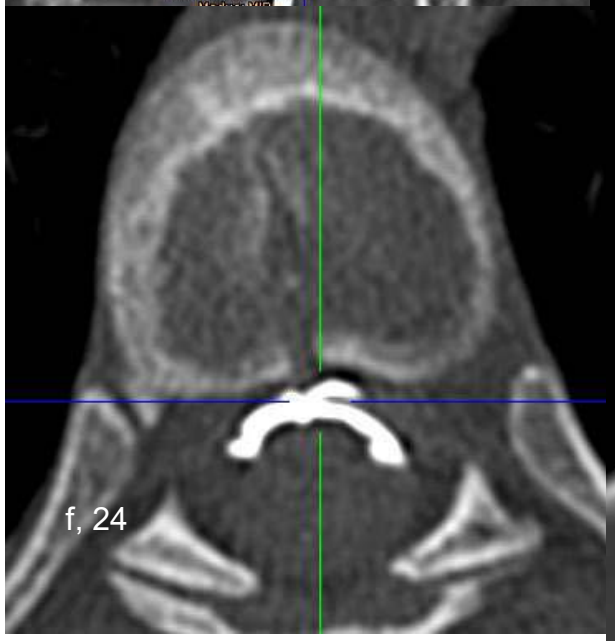


ventral leak Th7/8







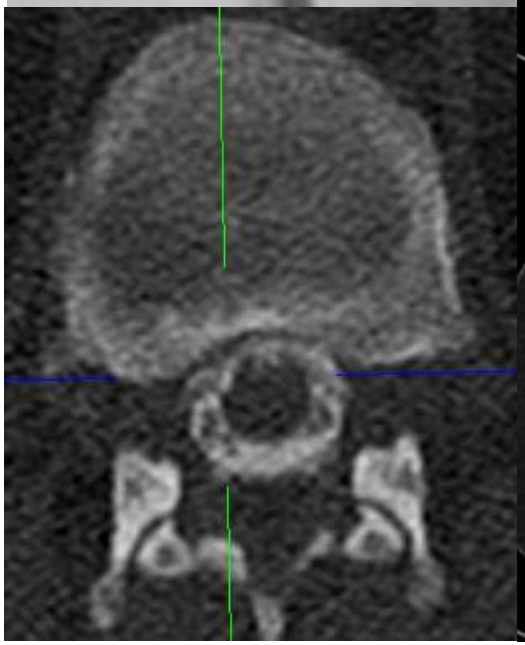






CT-guided targeted, „ventral“ Epidural Fibrin Patch

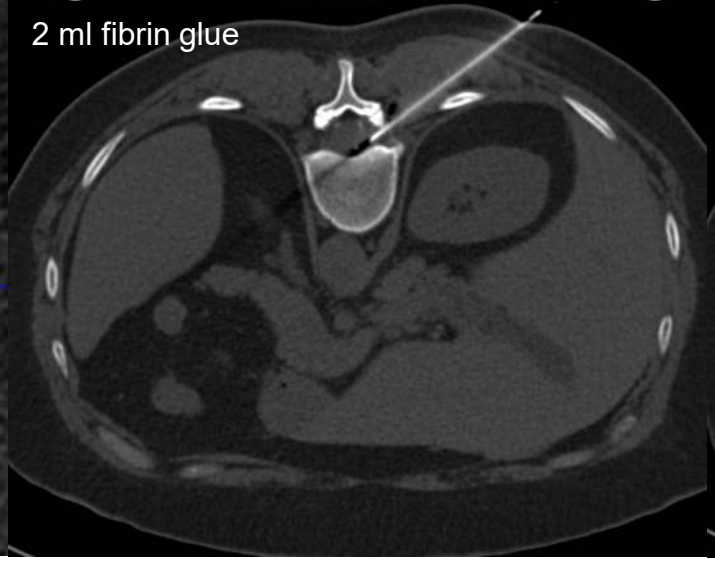


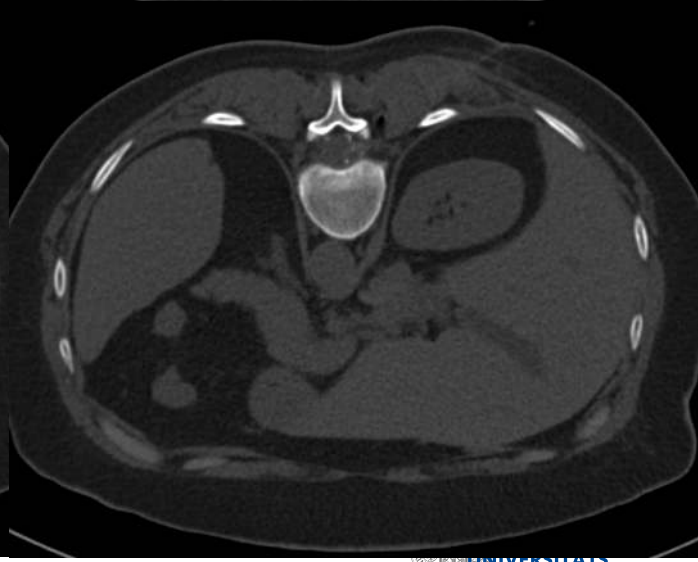


Es erfolgte ein CT-gesteuerter Fibrin-Patch im Bereich der ventralen Liquorleckage, wonach die Kopfschmerzsymptomatik vollständig sistierte.



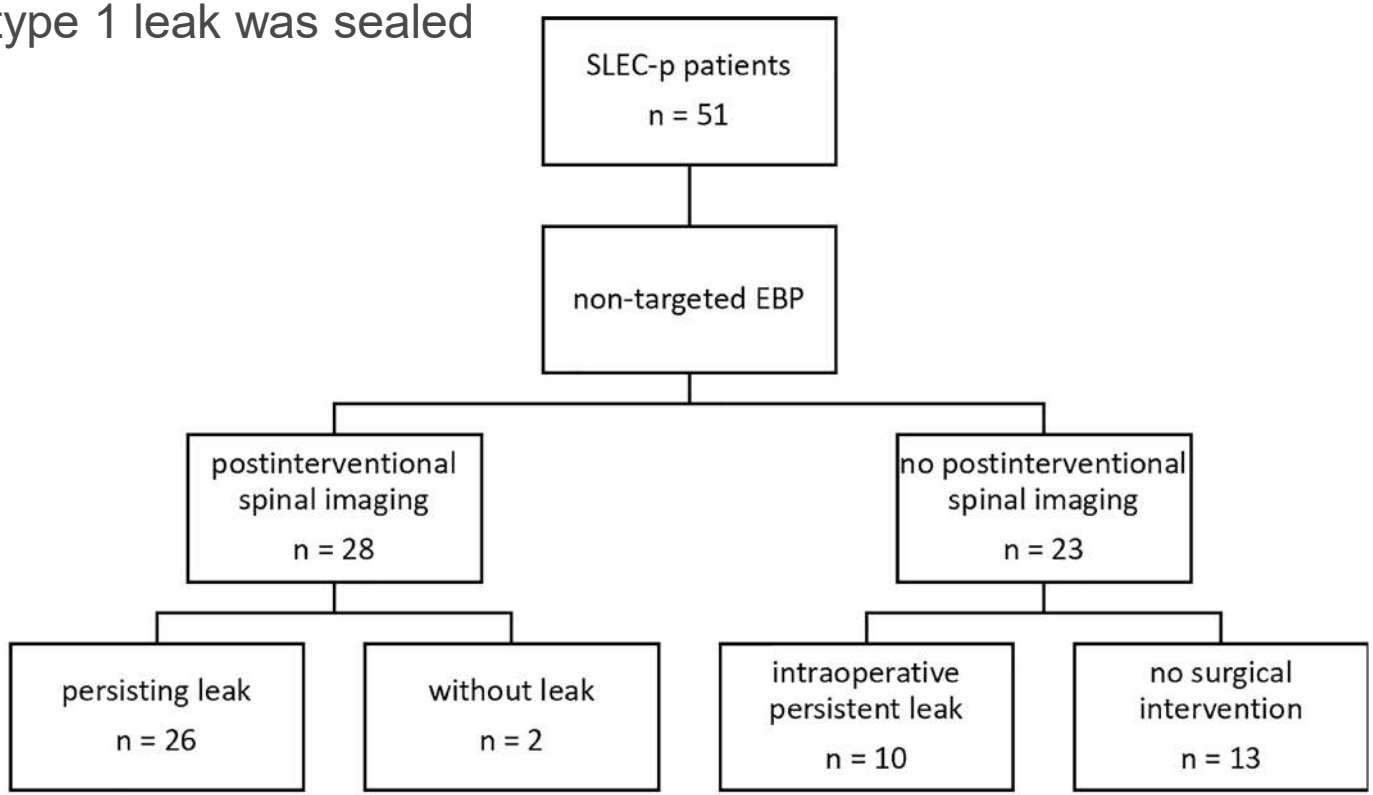






Non targeted Epidural Blood Patch

„In only 2 of 28 patients (both patients had a type 2 leak) the leak was sealed.“
→ no type 1 leak was sealed

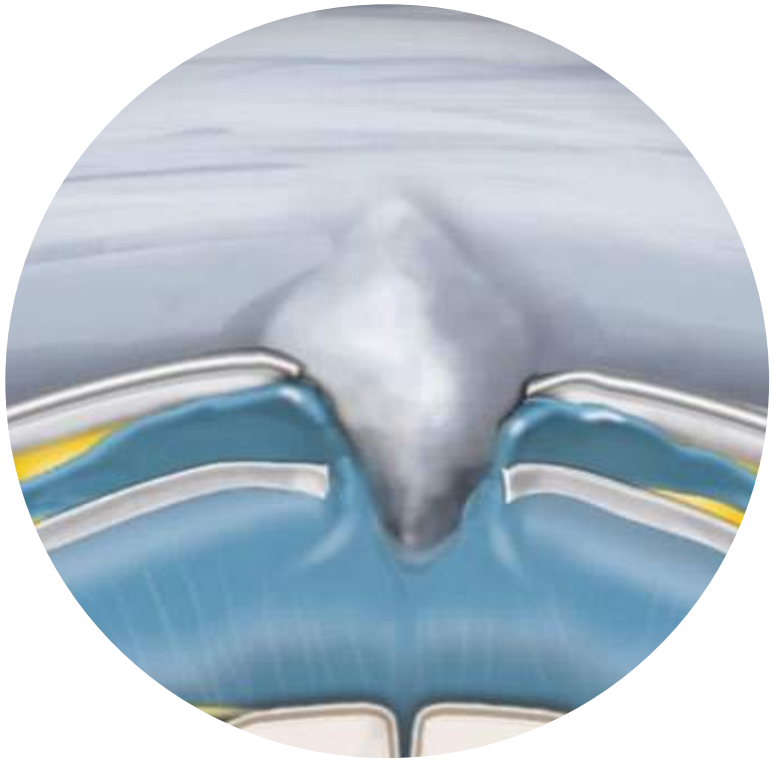


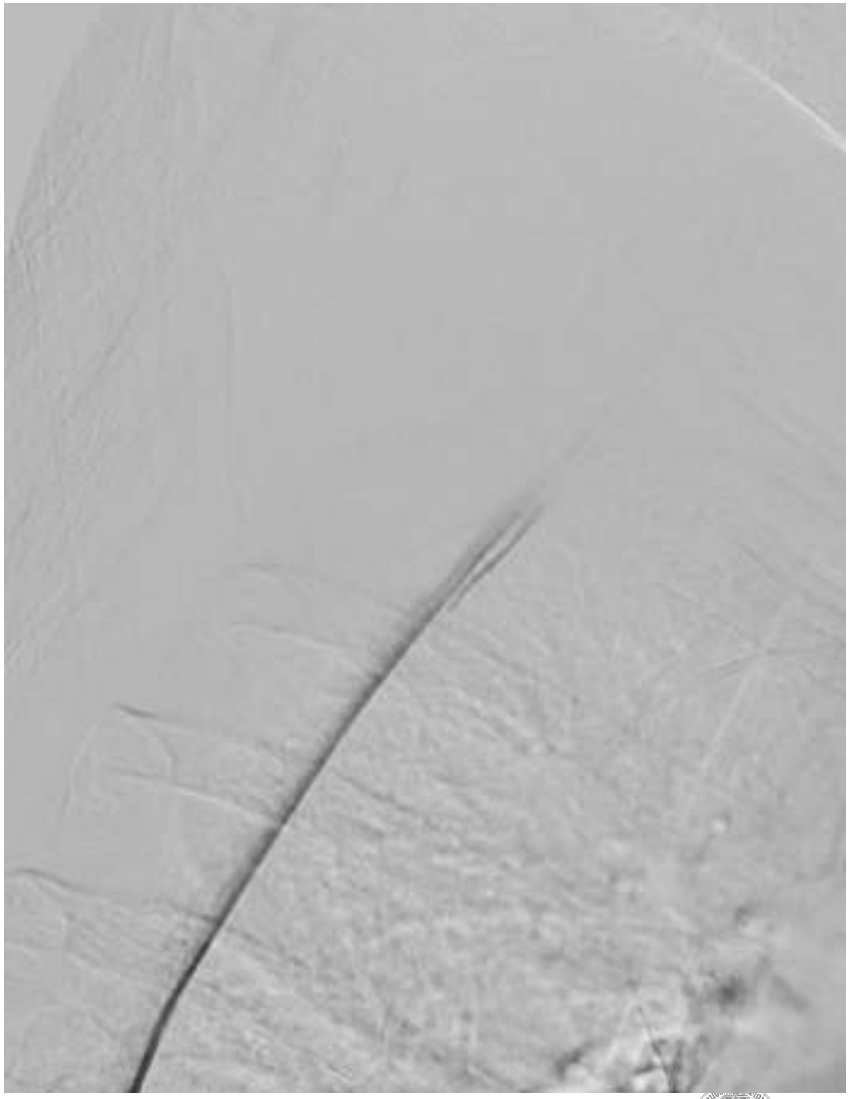
2 Type 2 leaks
(after 4, 2 EBP)

Piechowiak EI et at. Epidural Blood Patching in Spontaneous Intracranial Hypotension—Do we Really Seal the Leak? Clin Neuroradiol 2022

Type 1 leak:

Surgery > EBP



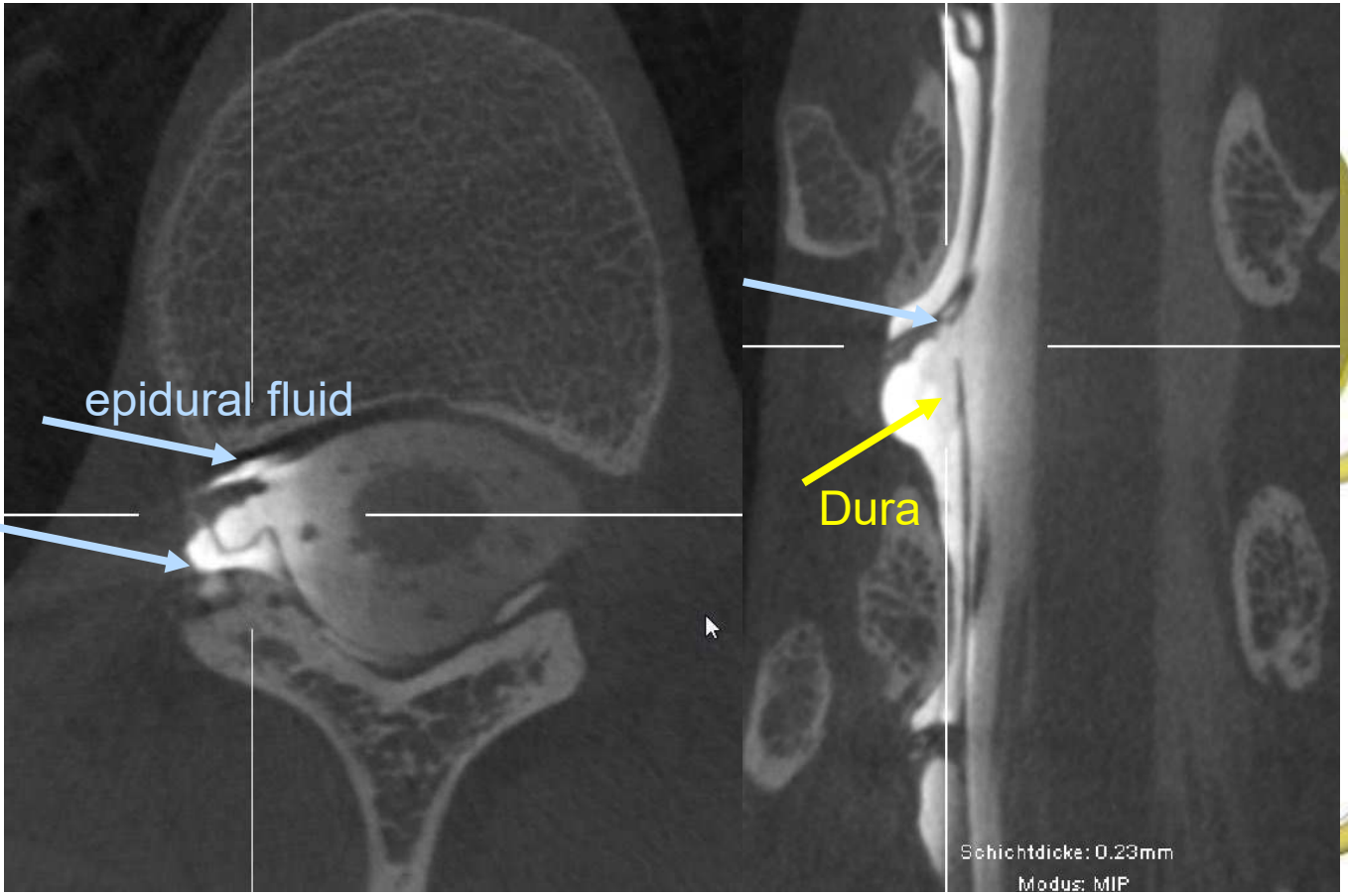


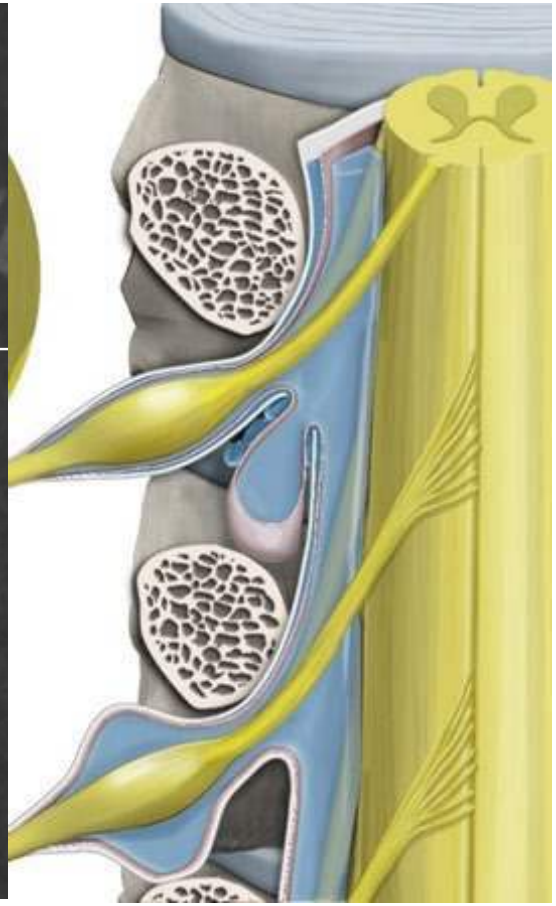
- Membrane formation
- Organized vs. non-organized SLEC

Häni L et al. Oper Neurosurg 2023, Callen A et al. Radiology 2025

Type 2 leak: CT-guided fibrin patch. Surgery, when it fails

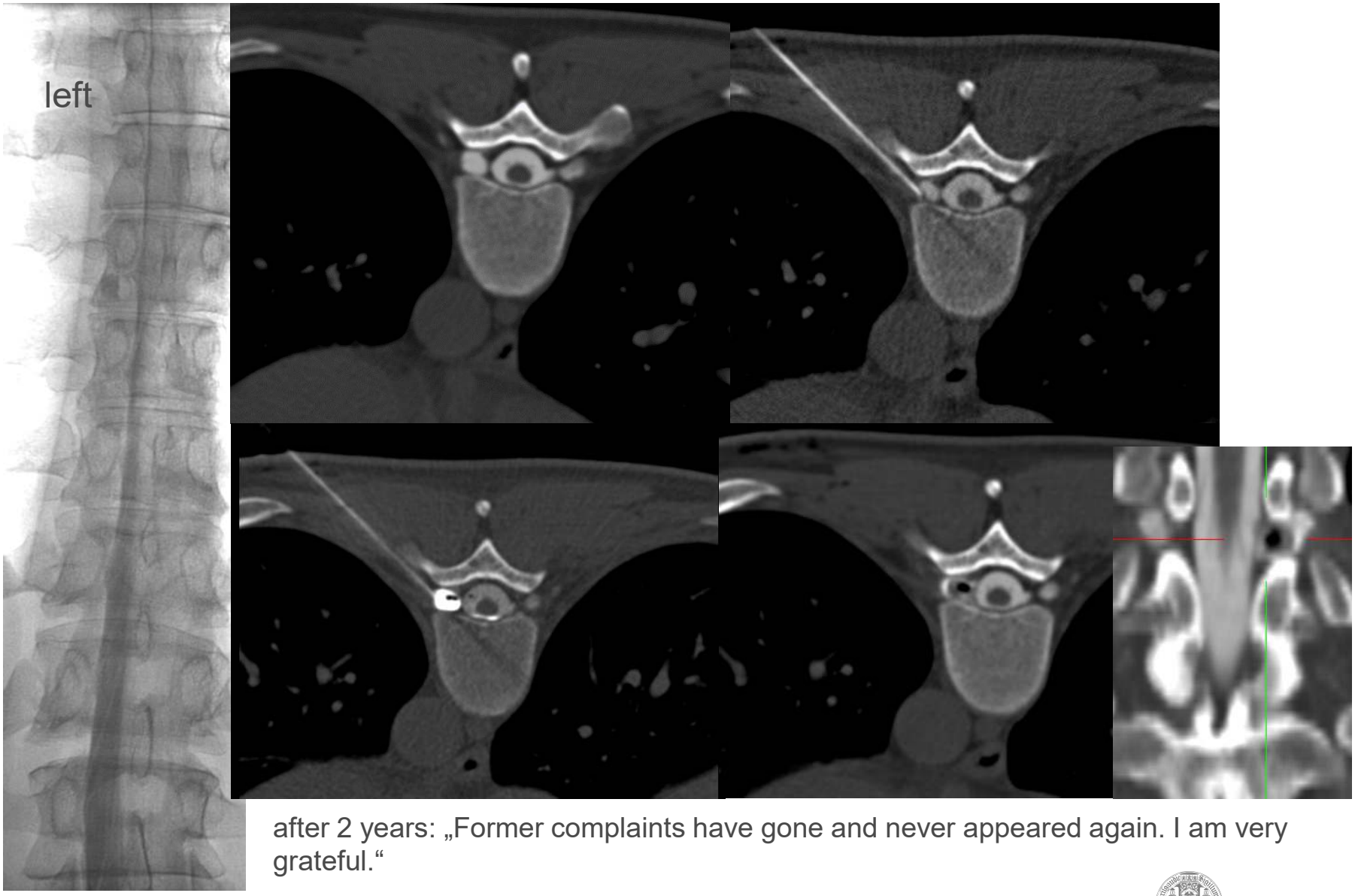
„Fill the arachnoid herniation and the surrounding“





Lützen N et al. Radiology 2025

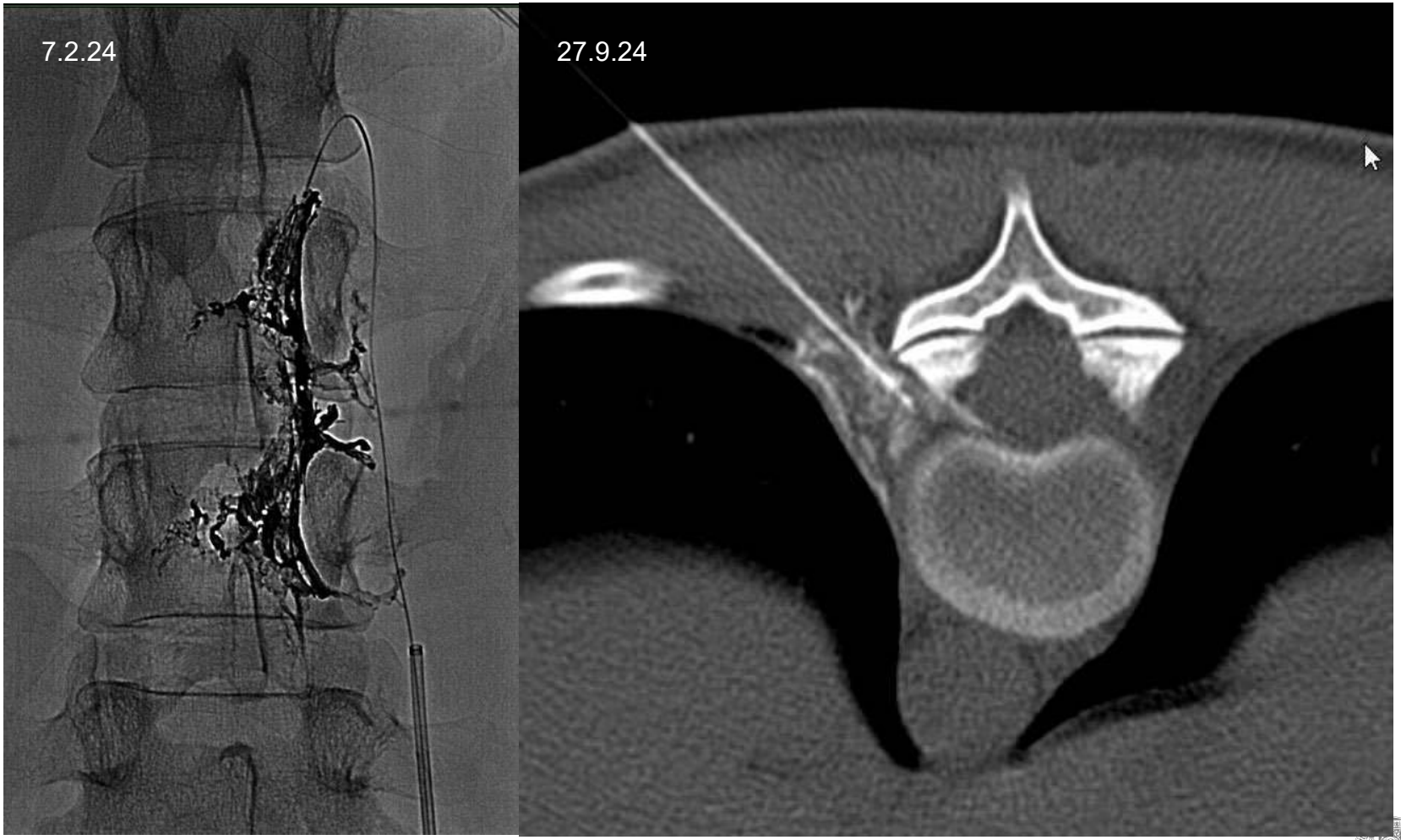
Type 2 leak: CT-guided fibrin patch. Surgery, when it fails



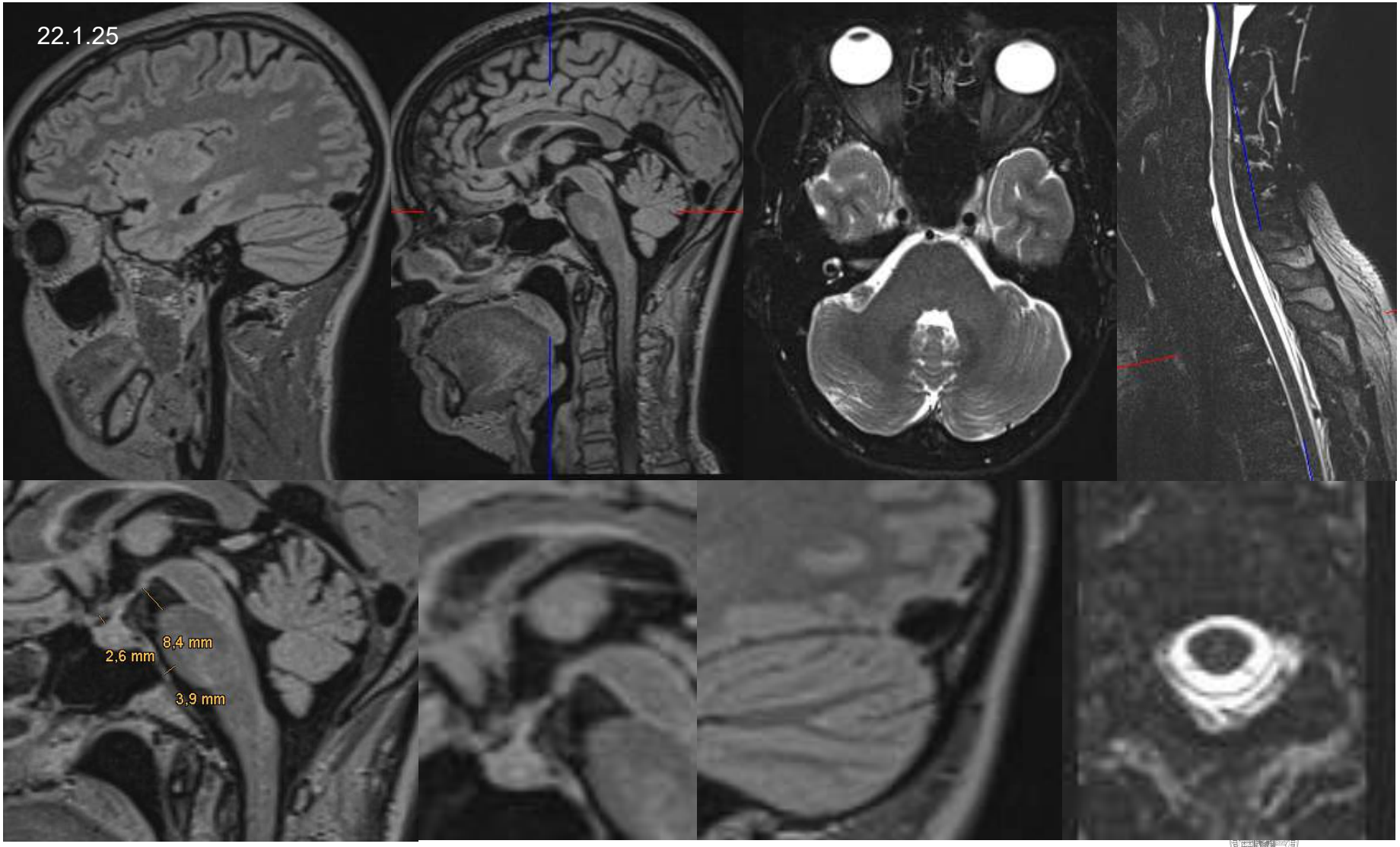
after 2 years: „Former complaints have gone and never appeared again. I am very grateful.“

Type 3 leak: CT-guided fibrin patch

Surgery or transvenous embolization, when it fails



PDPH after unintended dural puncture: after PDA, head +, SLEC +

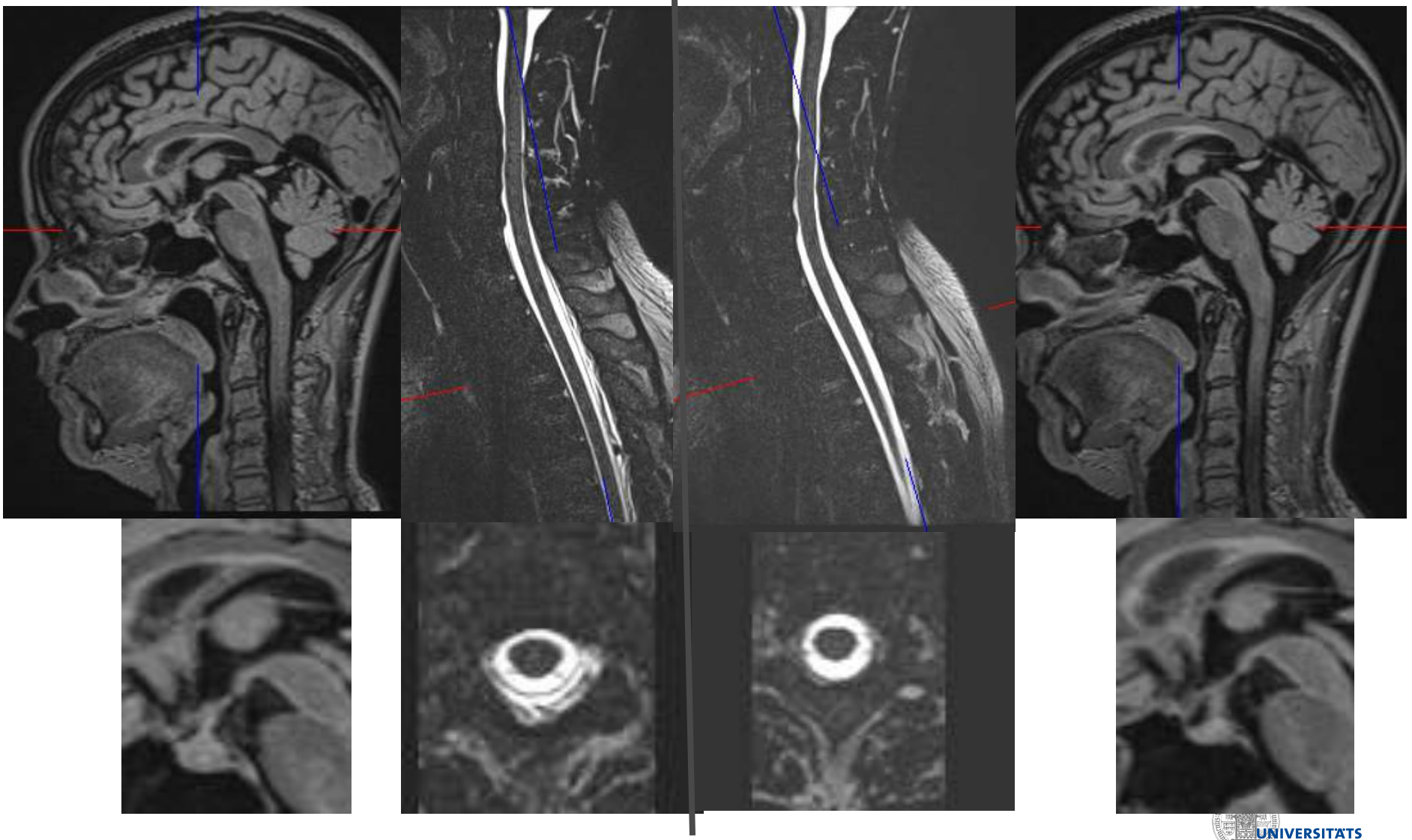


PDPH after unintended dural puncture: after PDA, head +, SLEC +



PDPH after unintended dural puncture: after PDA, head +, SLEC +

4 days after PDA



platelet rich fibrin (PRF) patch

PROTOKOLL	ZENTRIFUGAL-KRAFT	UMDREHUNGEN PRO MINUTE (UPM) BEI ZENTRIFUGEN-RADIUS VON 110 MM	ZEIT
PRF-High	710	2400	8
PRF-Medium	177	1200	8
PRF-Low	44	600	8

Vasilikos

Tabelle 1: Zentrifugationsprotokolle des Low Speed Centrifugation Concept (LSCC)



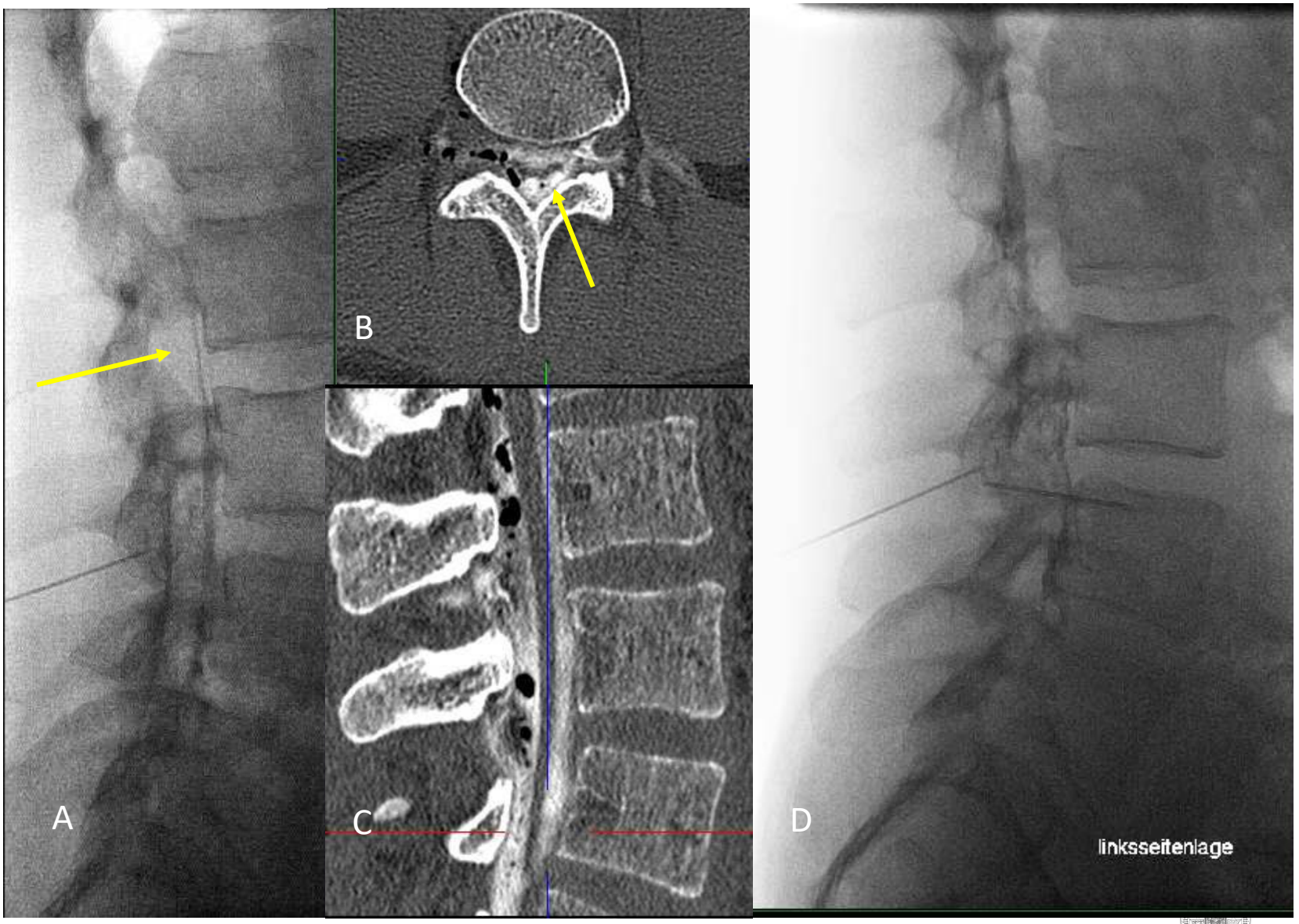
1 Solide PRF-Matrix nach der Zentrifugation



2 Flüssige PRF-Matrix nach der Zentrifugation

Ghanaati S, Al-Maawi S.15 Jahre Anwendung von Platelet-Rich Fibrin in der Zahnmedizin und Kieferchirurgie. Wie hoch ist der klinische Eviedenzgrad? https://pi.dental-online-channel.com/implantologie/anwendung_von_platelet_rich_fibrin/

platelet rich fibrin (PRF) patch

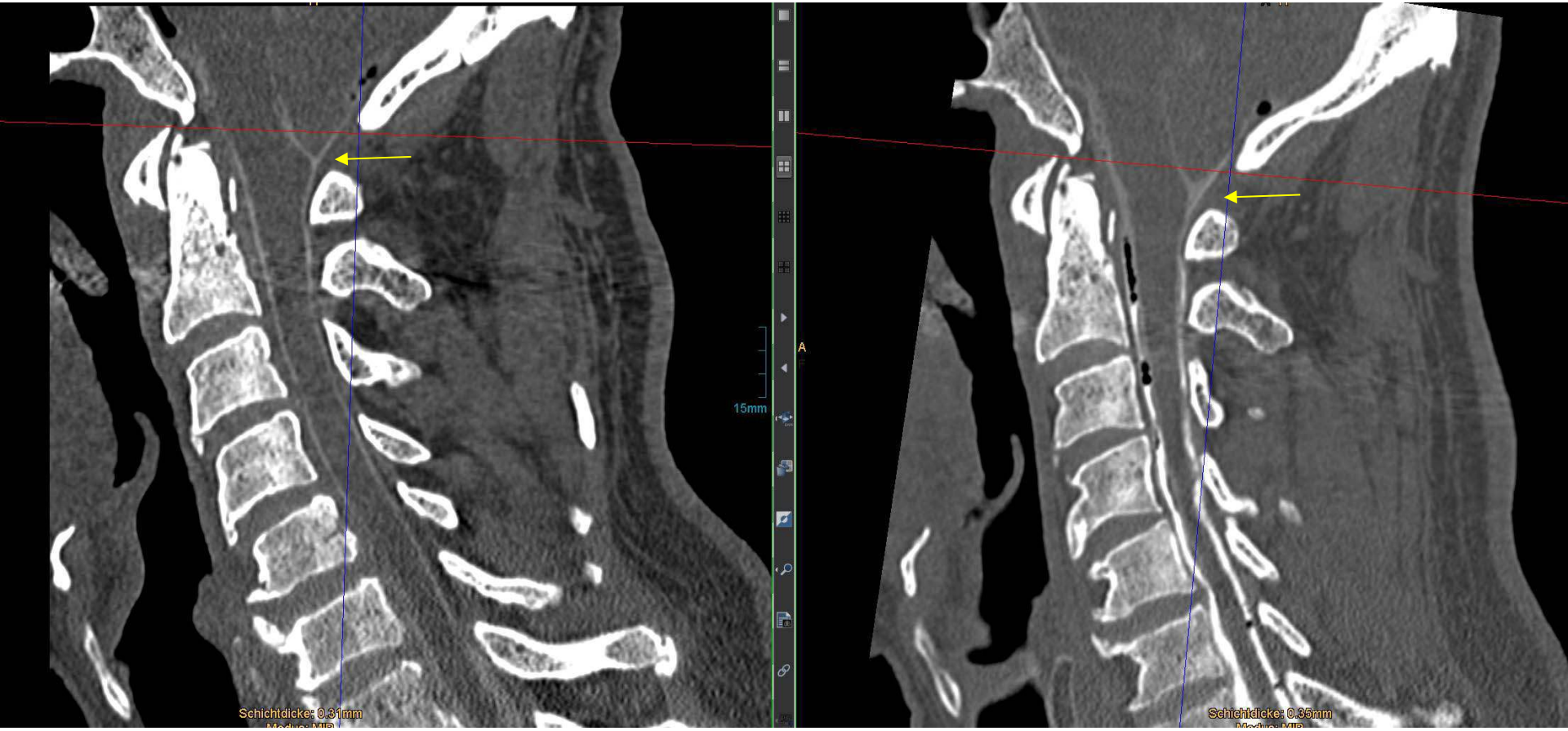


behavioral variant frontotemporal brain sagging syndrome

m, 60

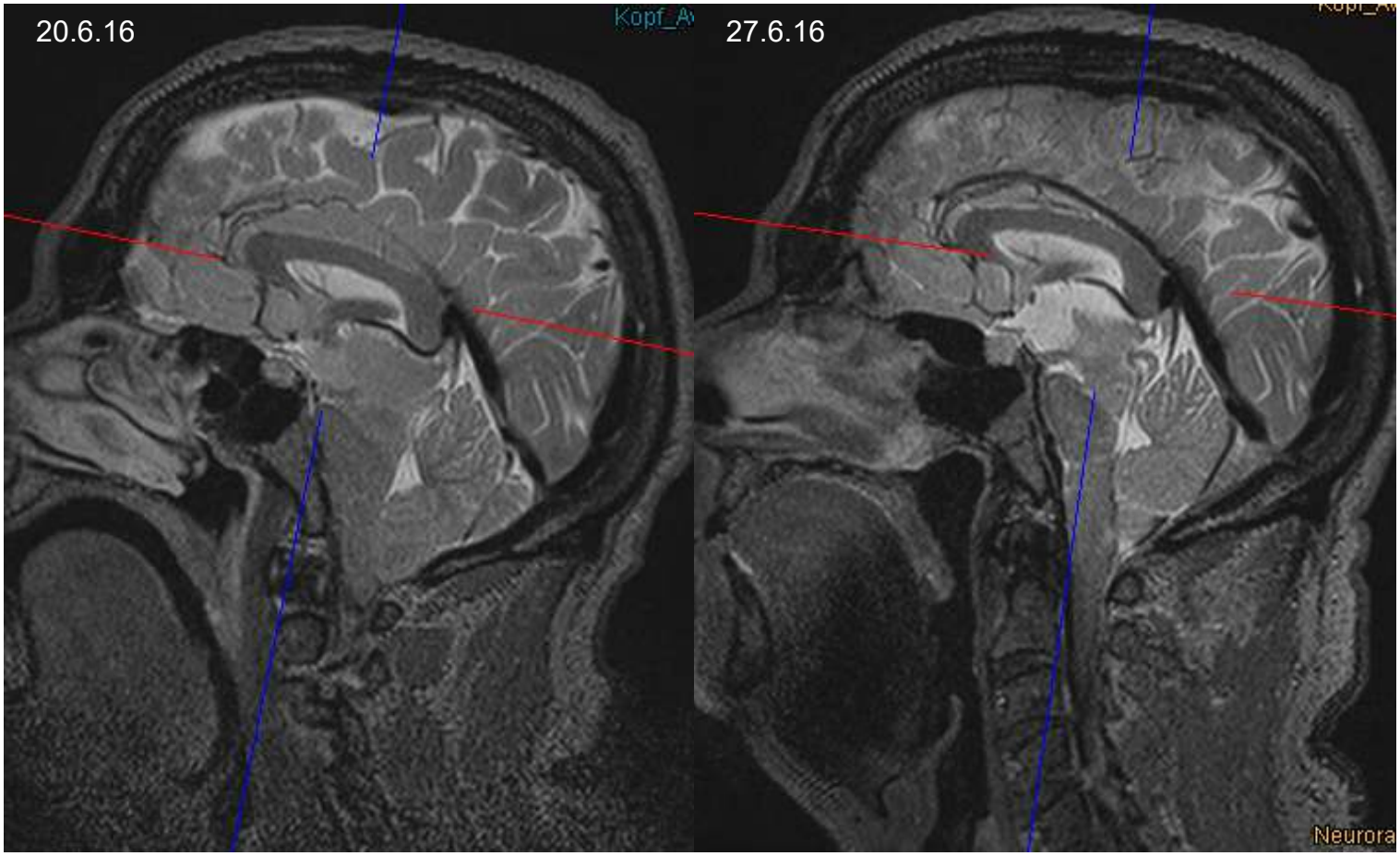
8.12.15: intrathecal injection

9.12.15: epidural injection



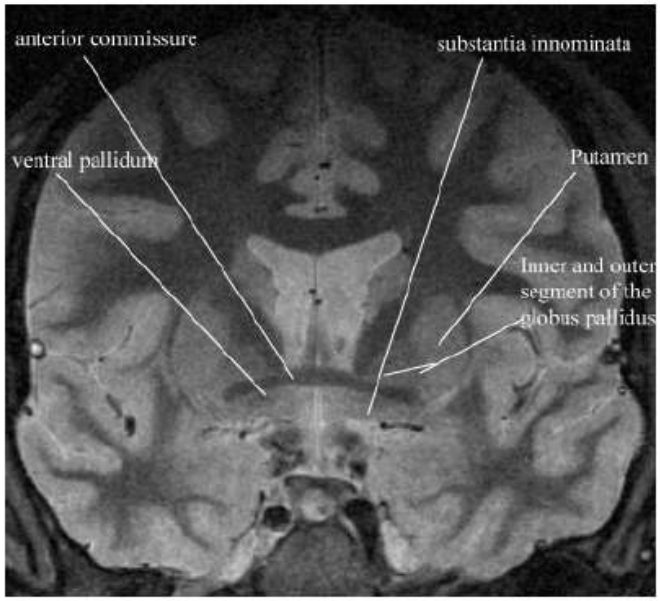
behavioral variant frontotemporal brain sagging syndrome

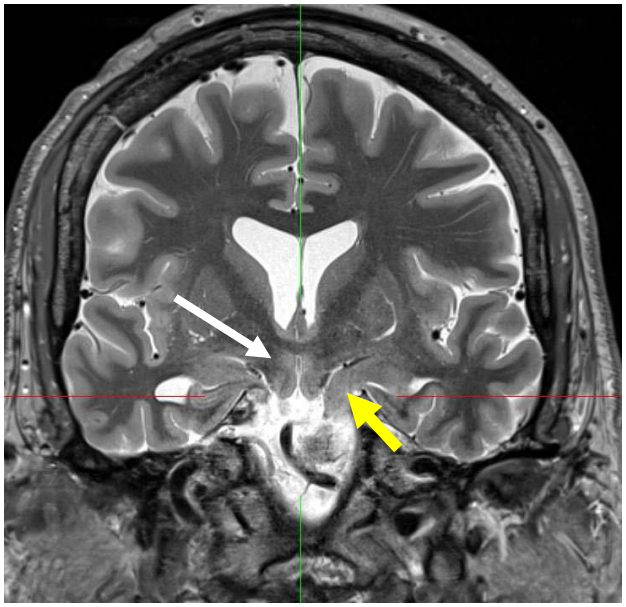
m, 60

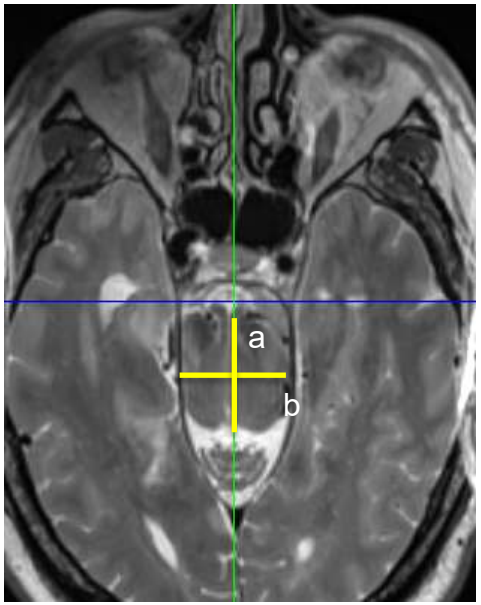


behavioral variant frontotemporal brain sagging syndrome

apathy, attention > memory deficits



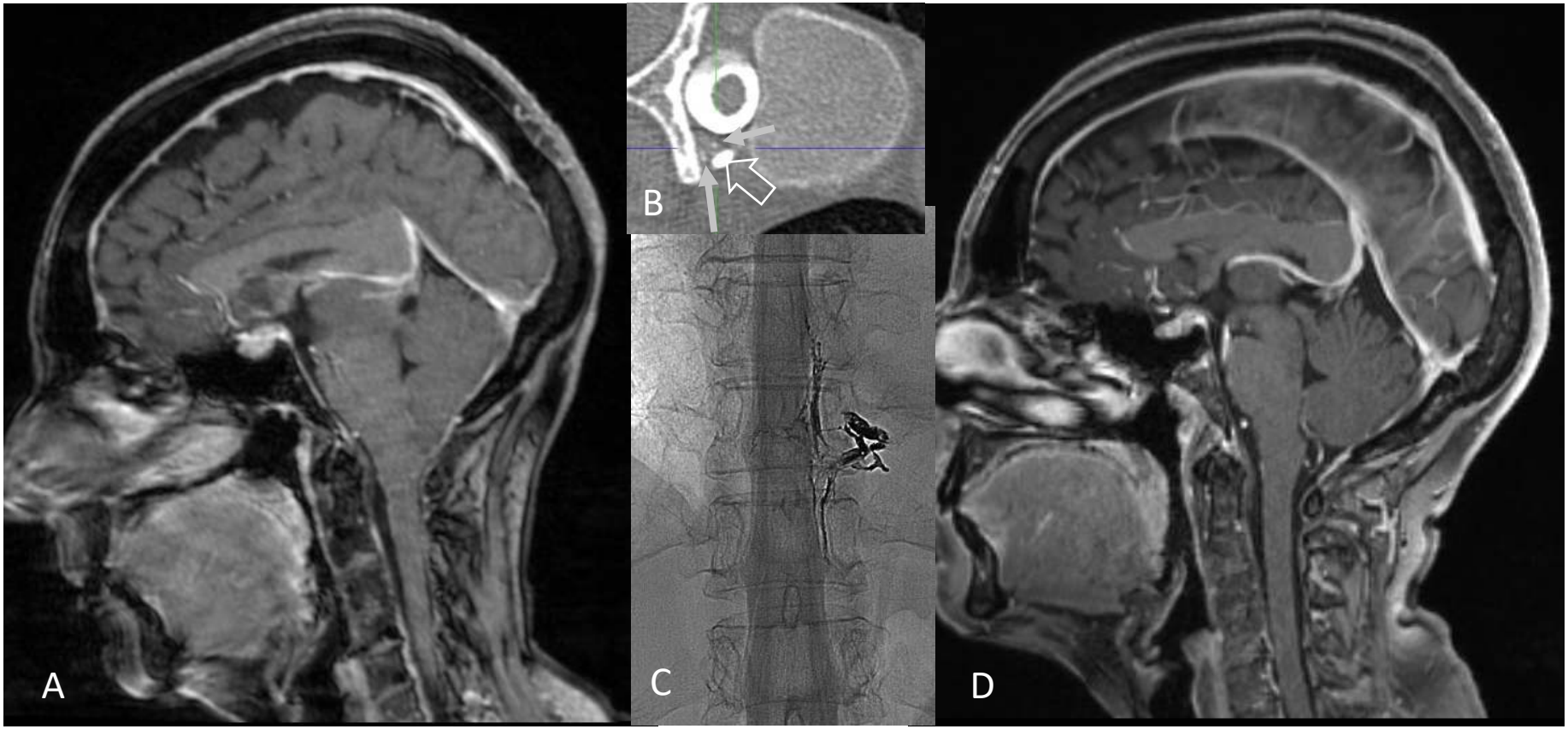




Teipel et al. Brain 2005;128: 2626–2644

behavioral variant frontotemporal brain sagging syndrome

f, 60, apathy, not able to handle the household any longer



Schievink WI et al. The reversible impairment of behavioral variant frontotemporal brain sagging syndrome: Challenges and opportunities. Alzheimer's Dement. 2022
Lützen N et al. Reversible frontotemporale Demenz bei spinaler Liquor-Vene-Fistel. Dtsch Ärztebl 2024
Urbach H et al. Spinal dementia: Don't miss it, it's treatable. Neuroradiology 2024

behavioral variant frontotemporal brain sagging syndrome →

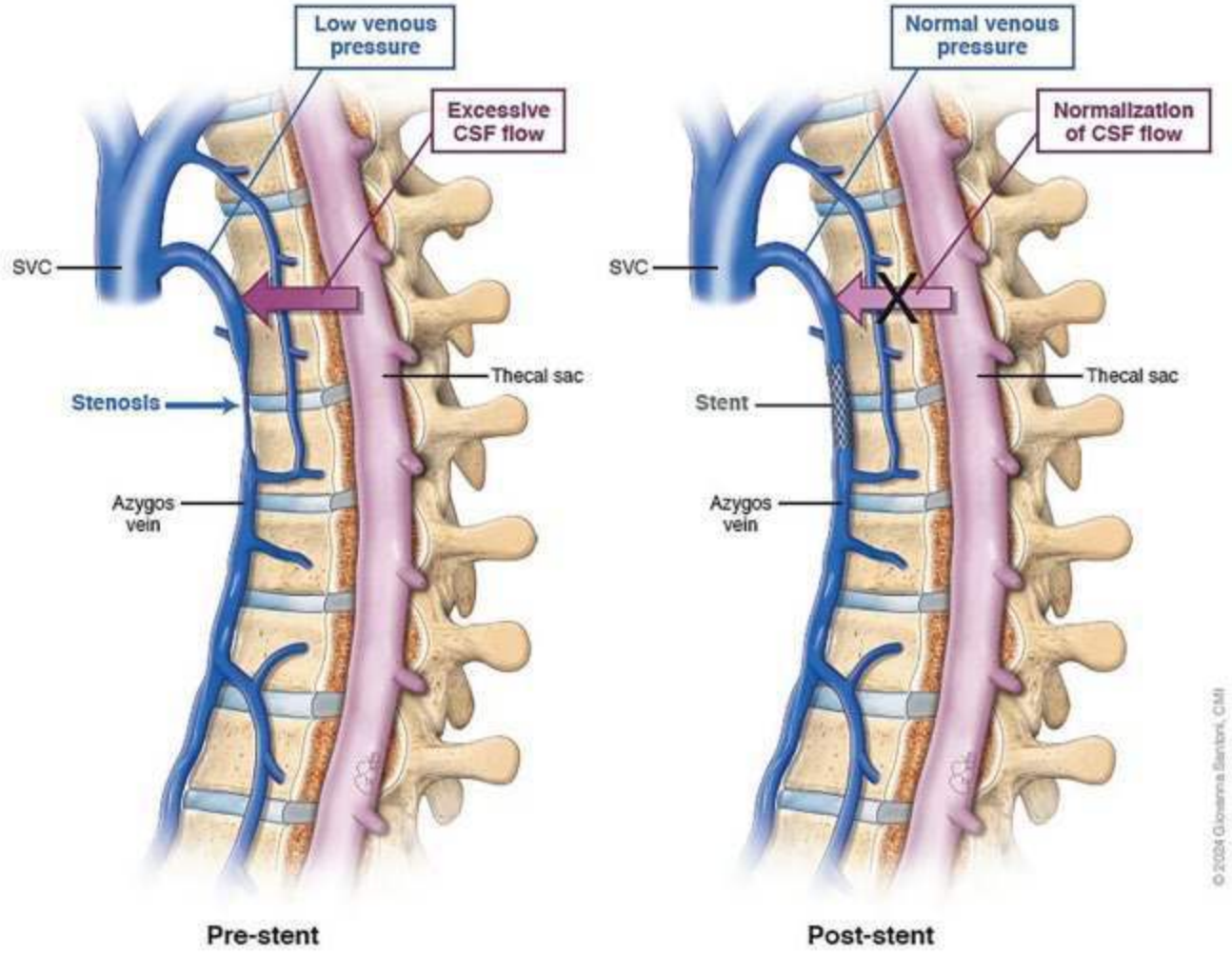
n=51 →
ventral dural tear n=1,
CVF n=12,
nothing n=38

In 2/3 of patients,
no CSF leak is found



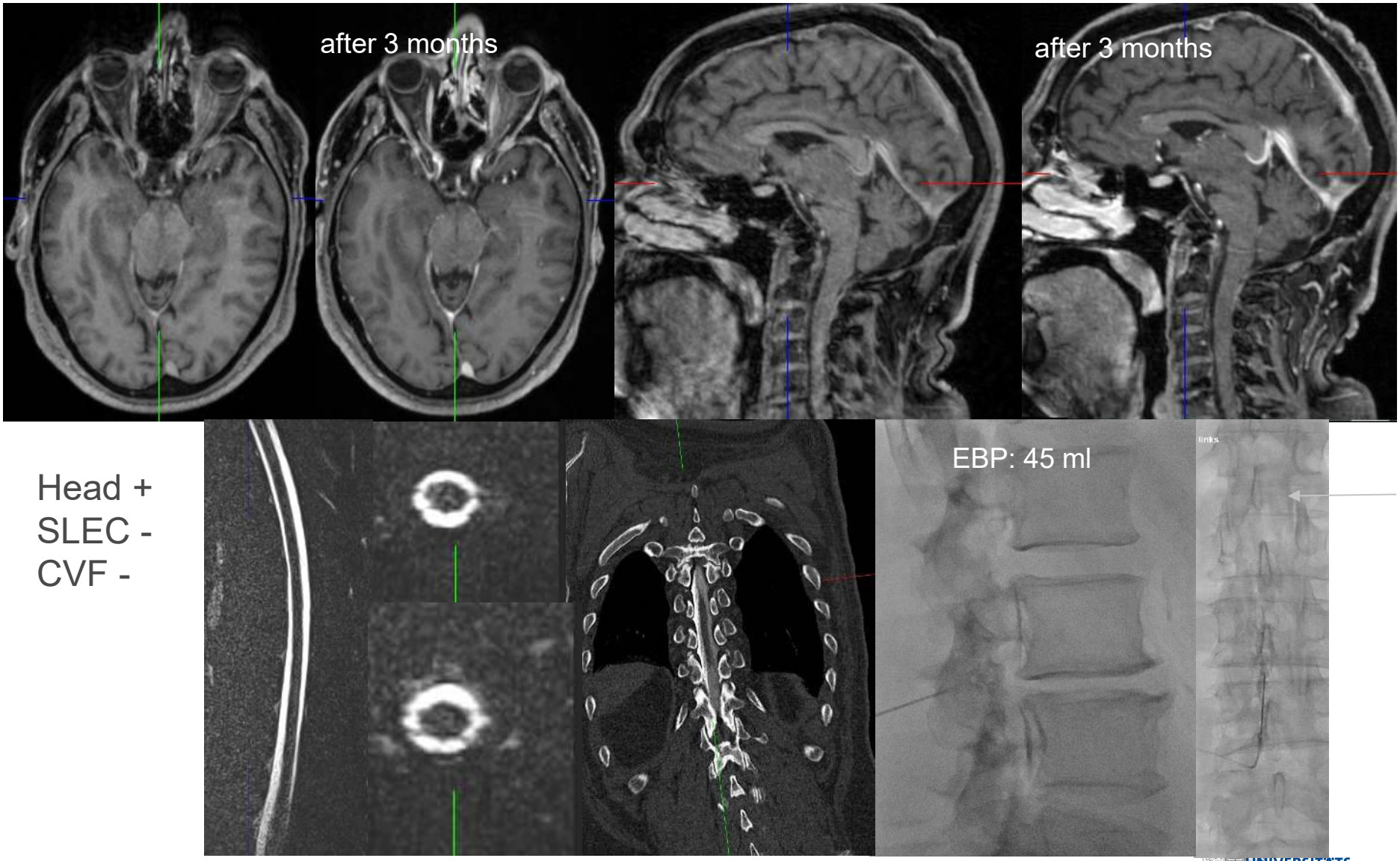
compulsive repetitive
flexion with breath-holding

Schmahmann J,
Schievink WI
Neurol Clin Pract 2024



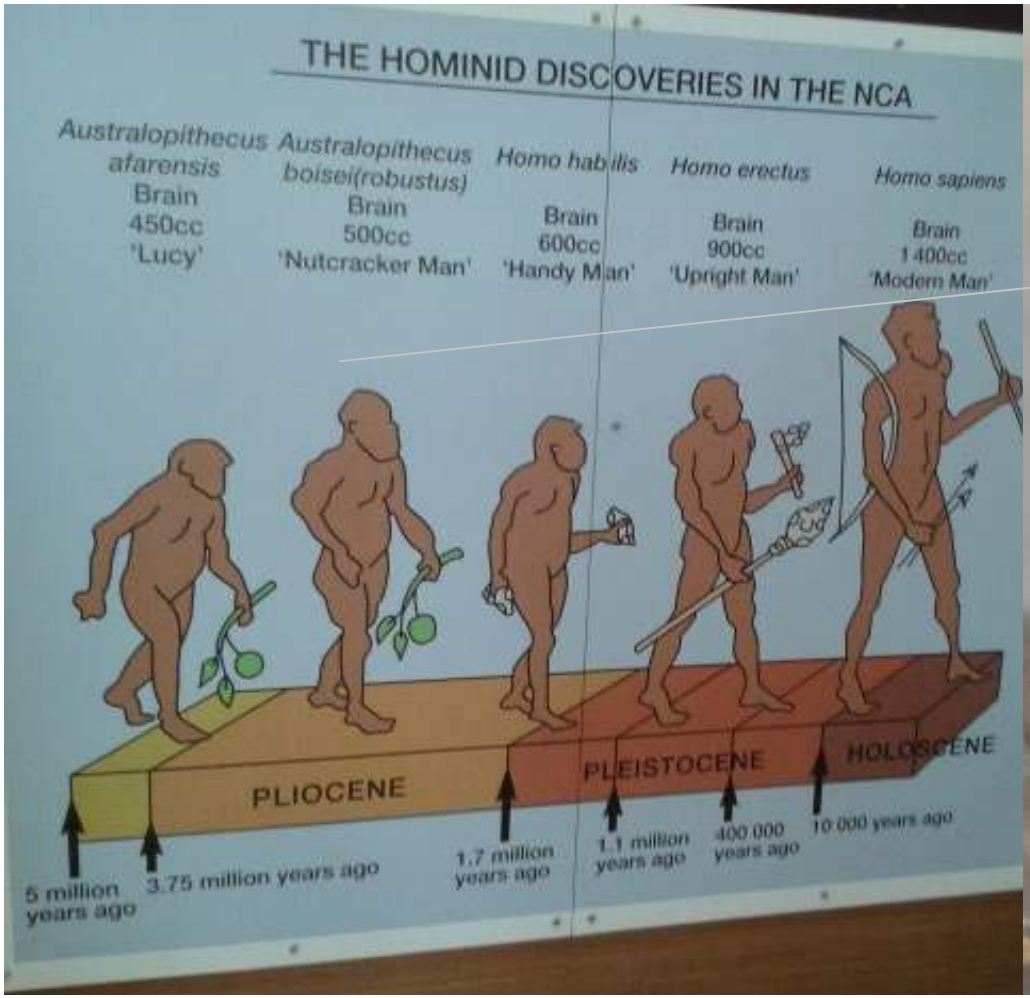
Schievink WI et al. Azygos Vein Stenosis in Frontotemporal Dementia Sagging Brain Syndrome. AJNR 2025

m, 62, brain sagging dementia, benefit from EBP with incomplete improvement



Why does a patient with a spinal CSF leak orthostatic headache?

Mary Leakey skull





Olduvai-Museum Tansania

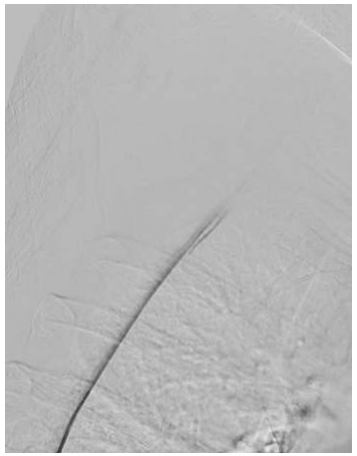
Why does a patient get a spinal CSF leak?

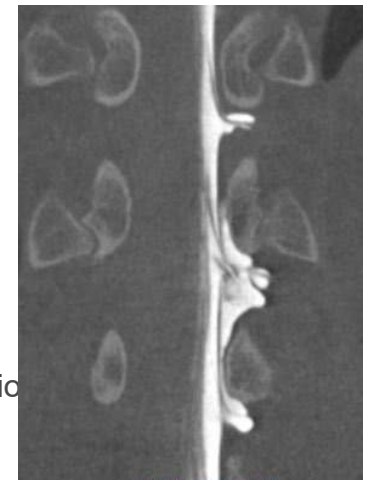


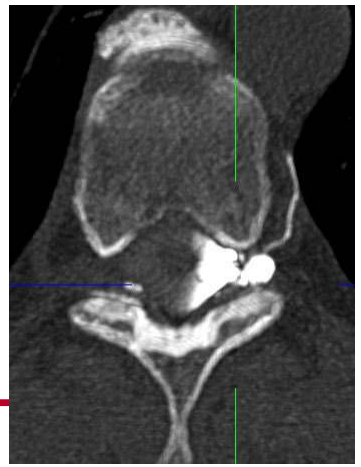
- foreign body pricks bicycle tube
  → bony spur (type 1 leak)

- worn bicycle tube
  → tissue weakness (type 2 leak)

- pressure to high
  → CSF venous fistula (pre-pressurizatio
  → leak from pre-existing IIH



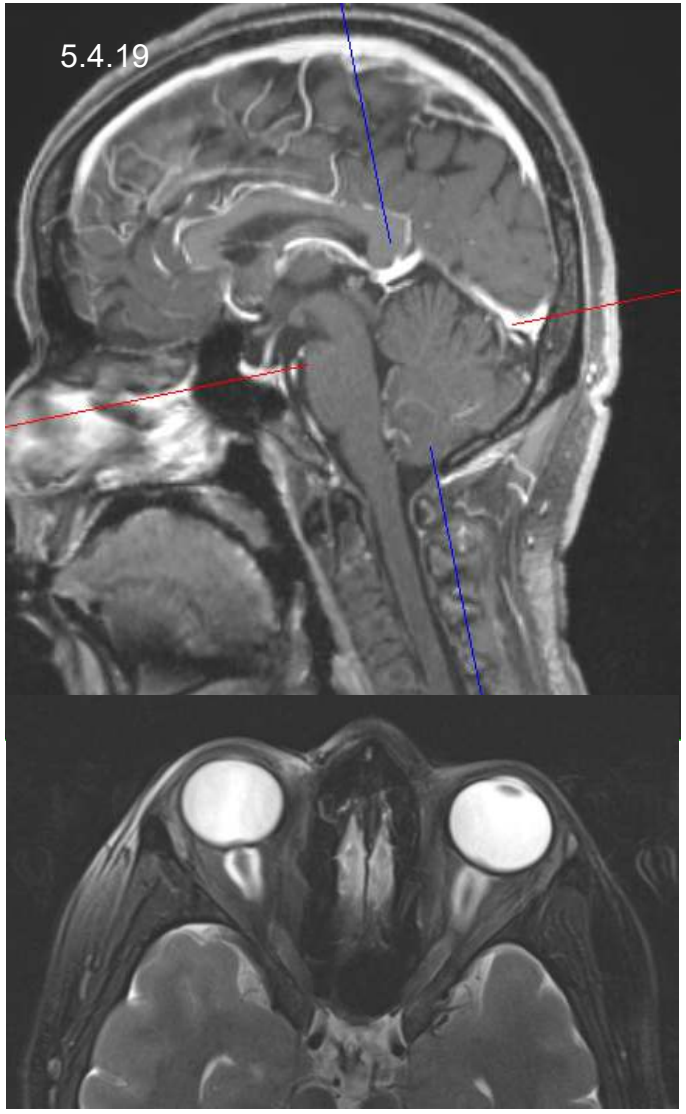


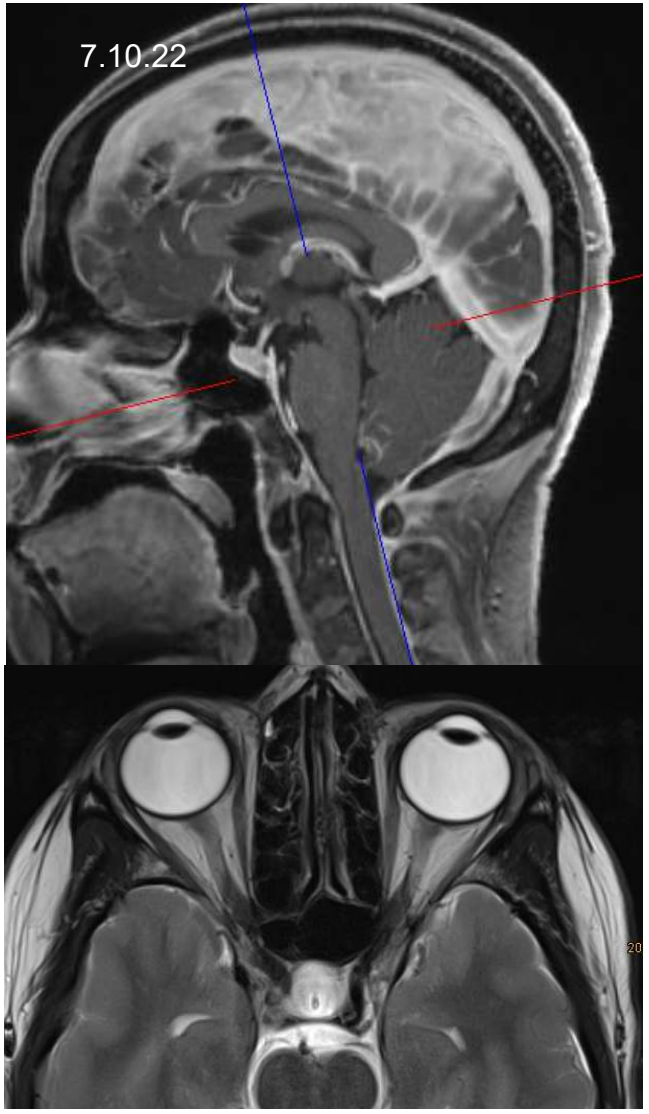


Dilemma: When a patient gets a CSF leak from preexisting IIH,
CSF pressure may be normal again and
IIH signs on MRI may have disappeared

IIH → lumbar puncture → intracranial hypotension → EBP$_{19.10.22}$: free of symptoms

♀, 42, BMI 32.9, papilledema

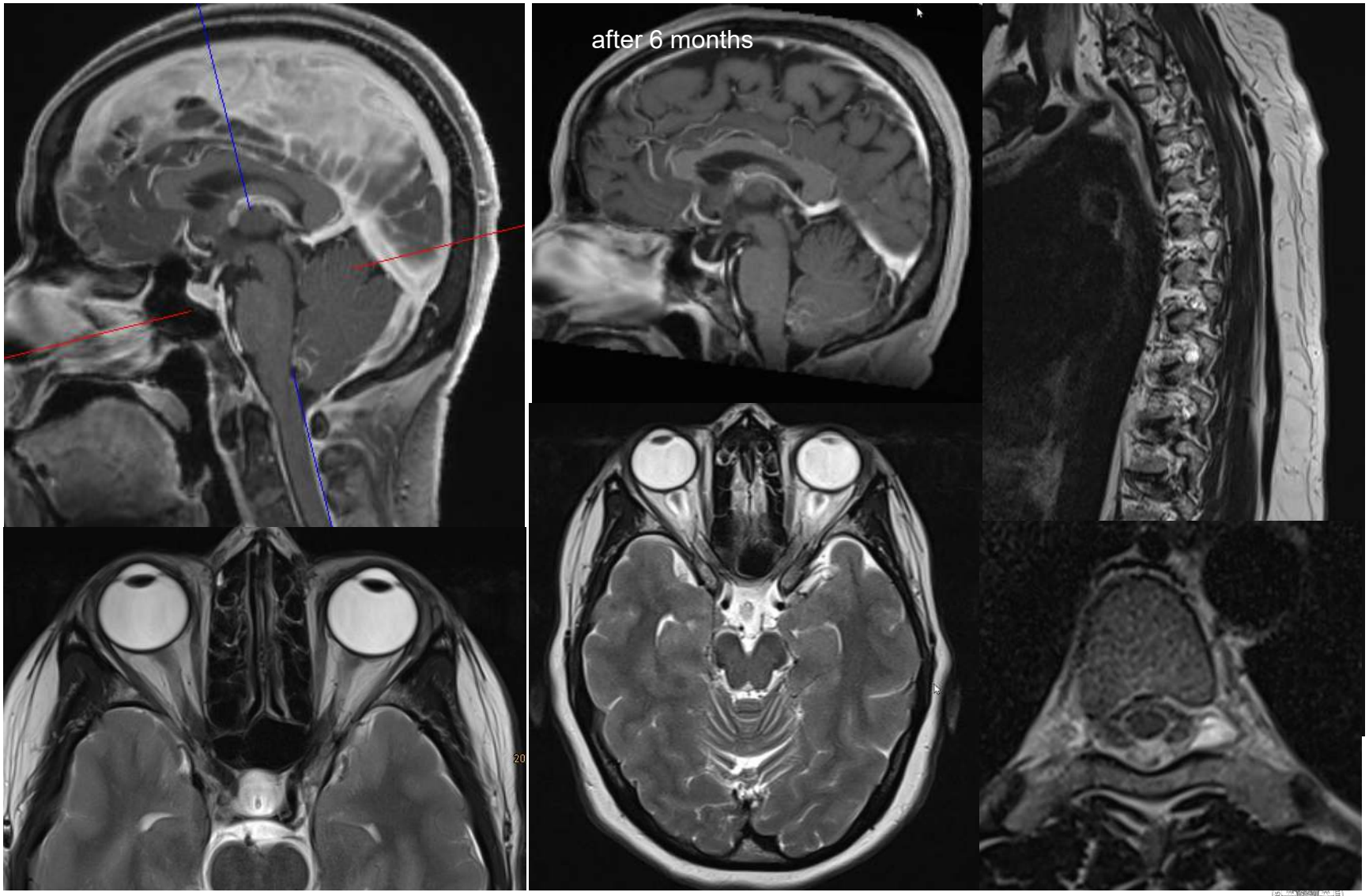






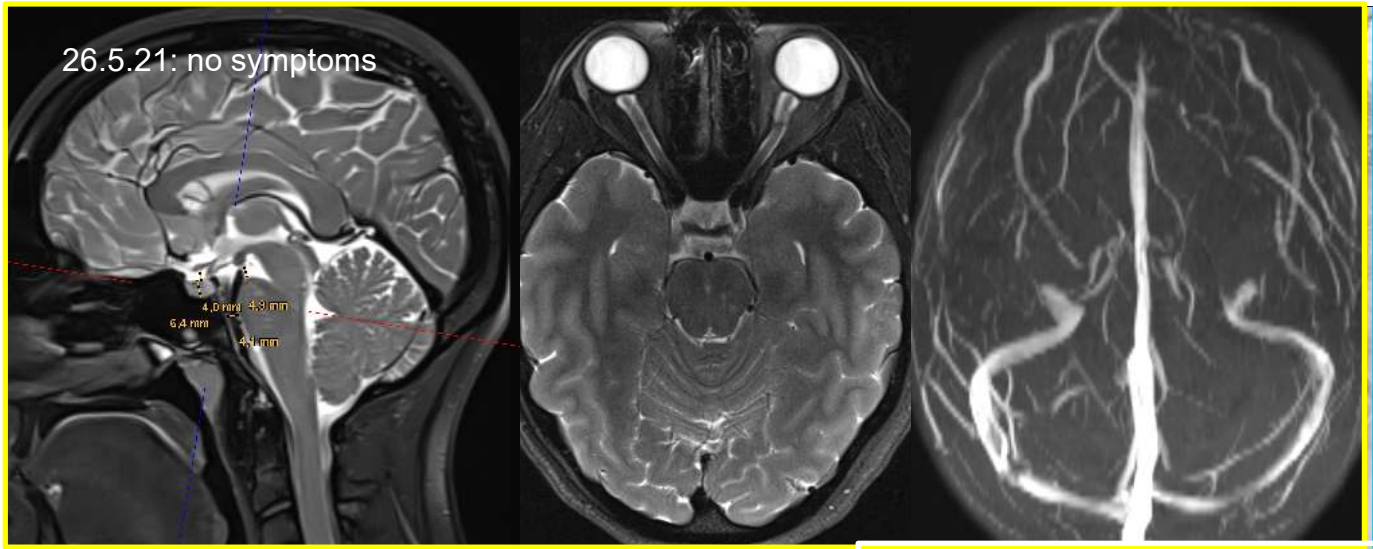
IIH→ lumbar puncture → intracranial hypotension → EBP 19.10.22

30.5.23: free of symptoms, persisting arachnid herniation

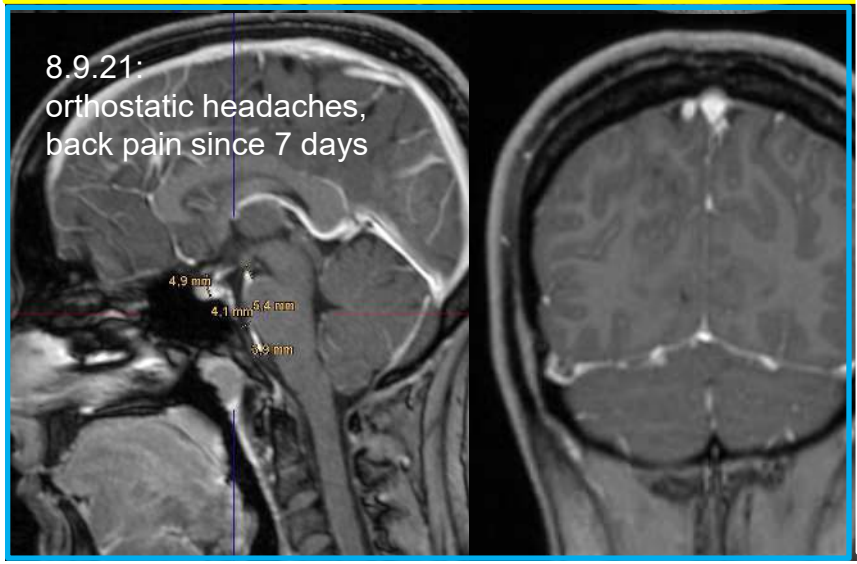


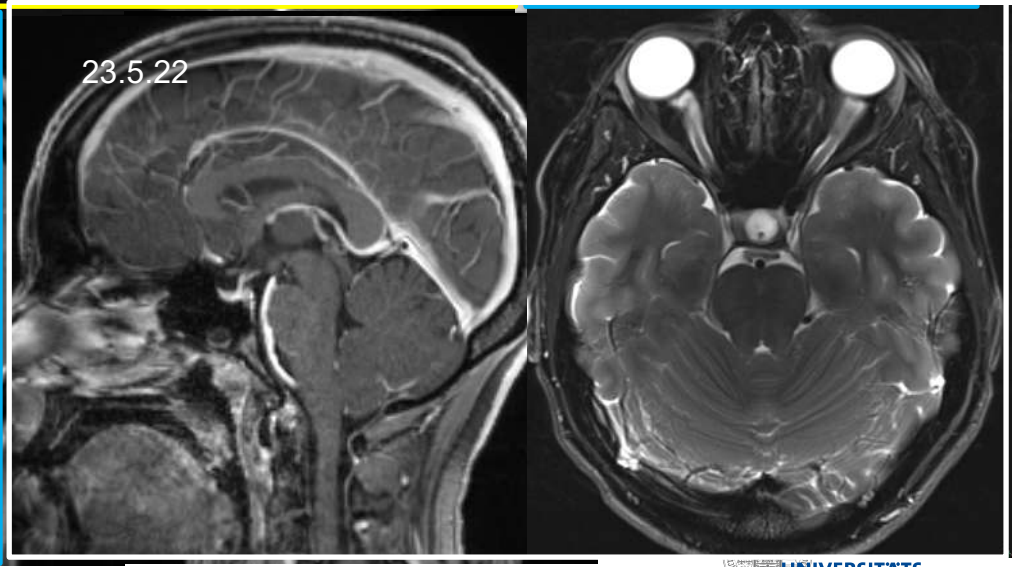
SIH from preexisting IIH

f, 32, BMI 29.4, MRI study: IIH signs, but no symptoms (A-C), orthostatic headches, smalll lateral dural tear, EBP

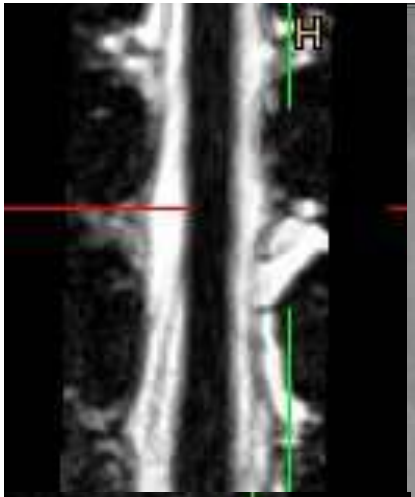




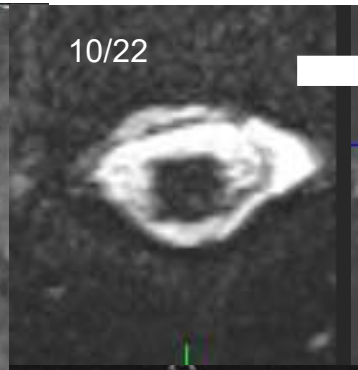


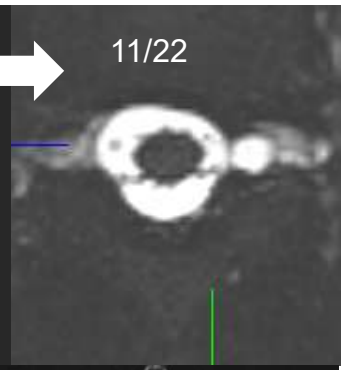


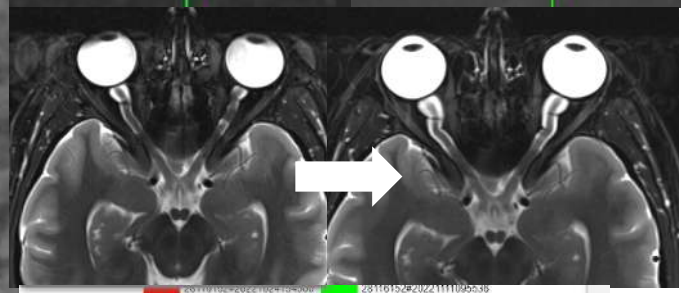
Type II leak, CT-guided targeted fibrin glue patch

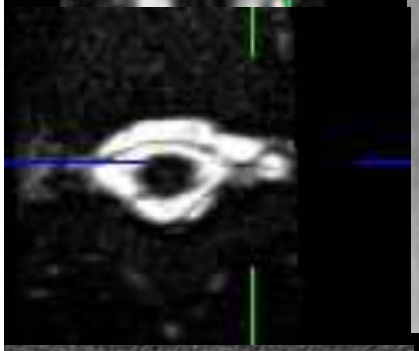








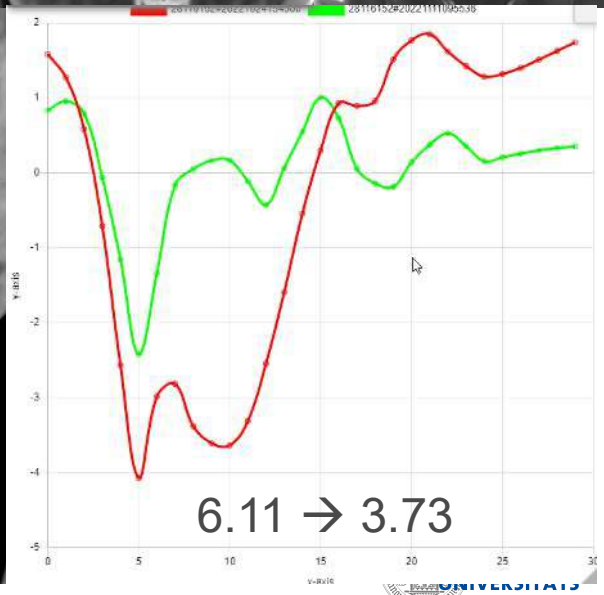


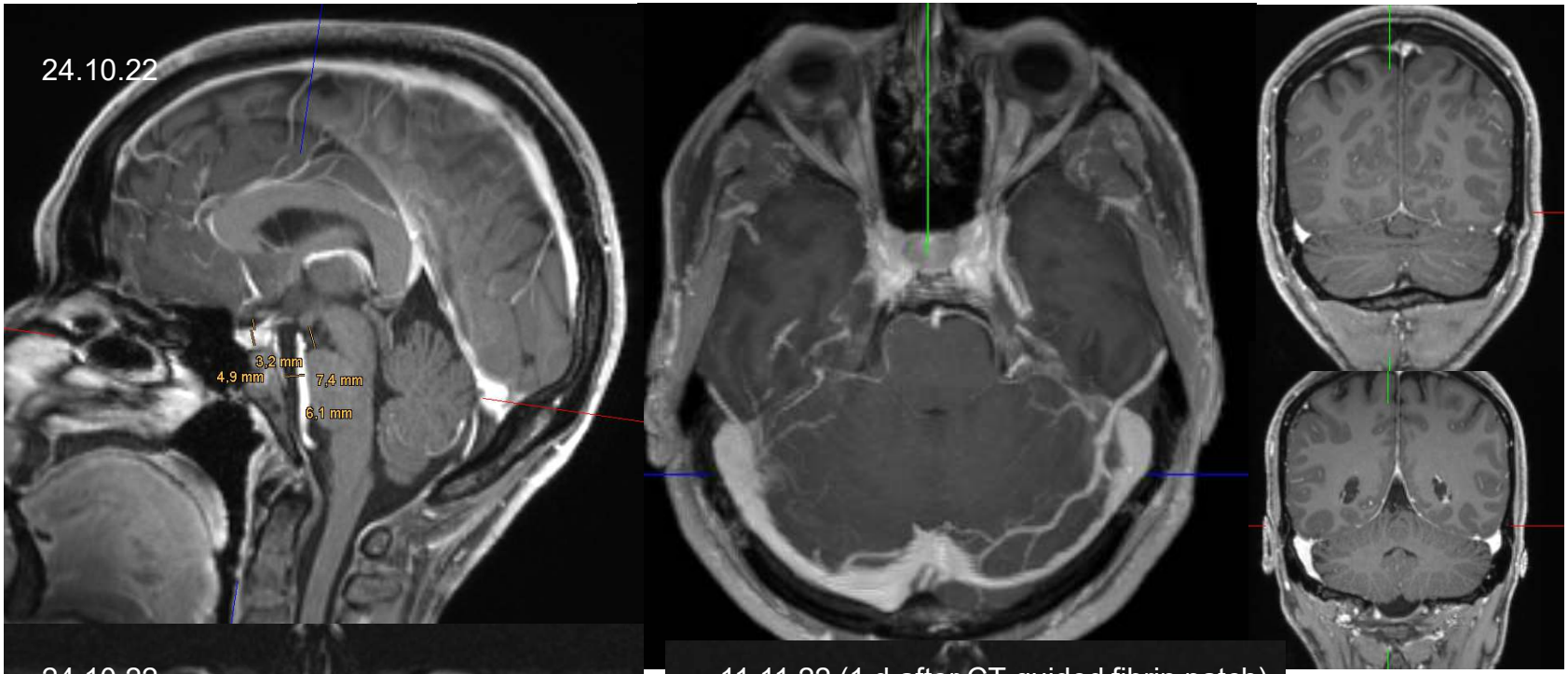


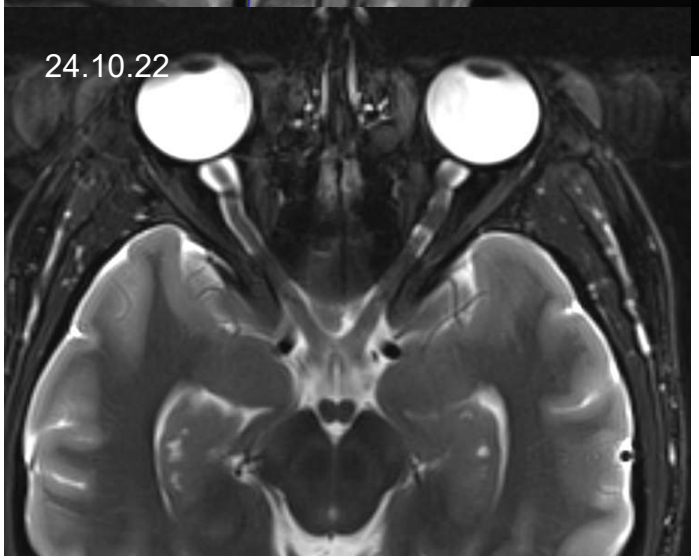


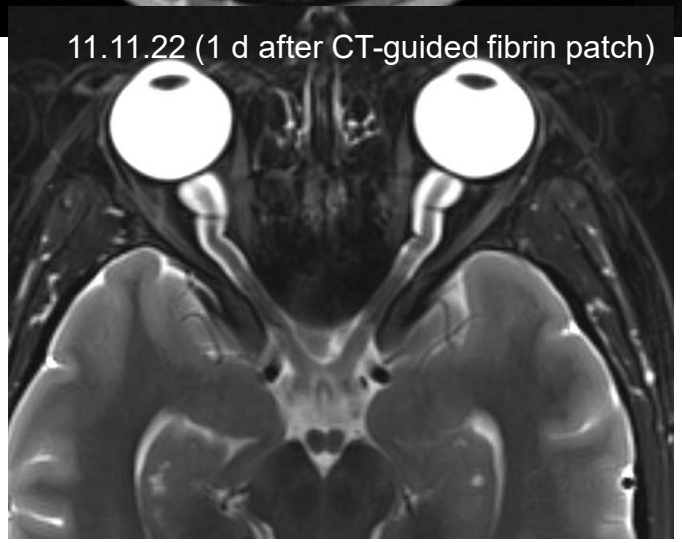







24.10.22
3,2 mm
4.9 mm
7,4 mm
6.1 mm


24.10.22


11.11.22 (1 d after CT-guided fibrin patch)

RIH

Preexisting intracranial hypertension should be considered in patients with refractory rebound intracranial hypertension.

Sulioti G, Gray L, Amrhein TJ. Popping the balloon: abrupt onset of a spinal CSF leak and spontaneous intracranial hypotension in idiopathic intracranial hypertension, a case report. Headache. 2022;62:208-211

Callen A et al. Diagnosis and Treatment of Spontaneous Intracranial Hypotension: Role of Epidural Blood Patching. Neurology Clin Practice 2024

Summary

- current indications:
  PDPH, Type 2 leaks with small arachnoid herniations, sacral leaks,
  spinal dementia with no leak

- Inject as much blood as possible * and check that the contrast flows upwards
- Prefer fribrin injections if the leak is identified
- Aim at sealing the leak + increasing epidural space pressure

* Wu J et al. Factors predicting response to the first epidural blood patch in spontaneous intracranial hypotension. Brain 2017;140:344

Lee JY et al. Clinical effect of the proximity of epidural blood patch injection to the leakage site in spontaneous intracranial hypotension. Br J Neurosurg. 2018;32:671

Amrhein T et al. Efficacy of epidural blood patching or surgery in spontaneous intracranial hypotension: an evidence map protocol. Systematic Reviews 2022;11:116

D'Antona L et al. Clinical presentation, investigation findings, and treat-ment outcomes of spontaneous intracranial hypotension syndrome: a systematic review and meta-analysis. JAMA Neurol. 2021;78:329