2025 Intracranial Hypotension Conference

Amsterdam June 28-29

Surgical treatment of PDPH

Post Dural Puncture Headache

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Medical Center – University of Freiburg, Germany

Chair CSF-Section - European Association of Neurosurgical Societies

Procedural risk factors

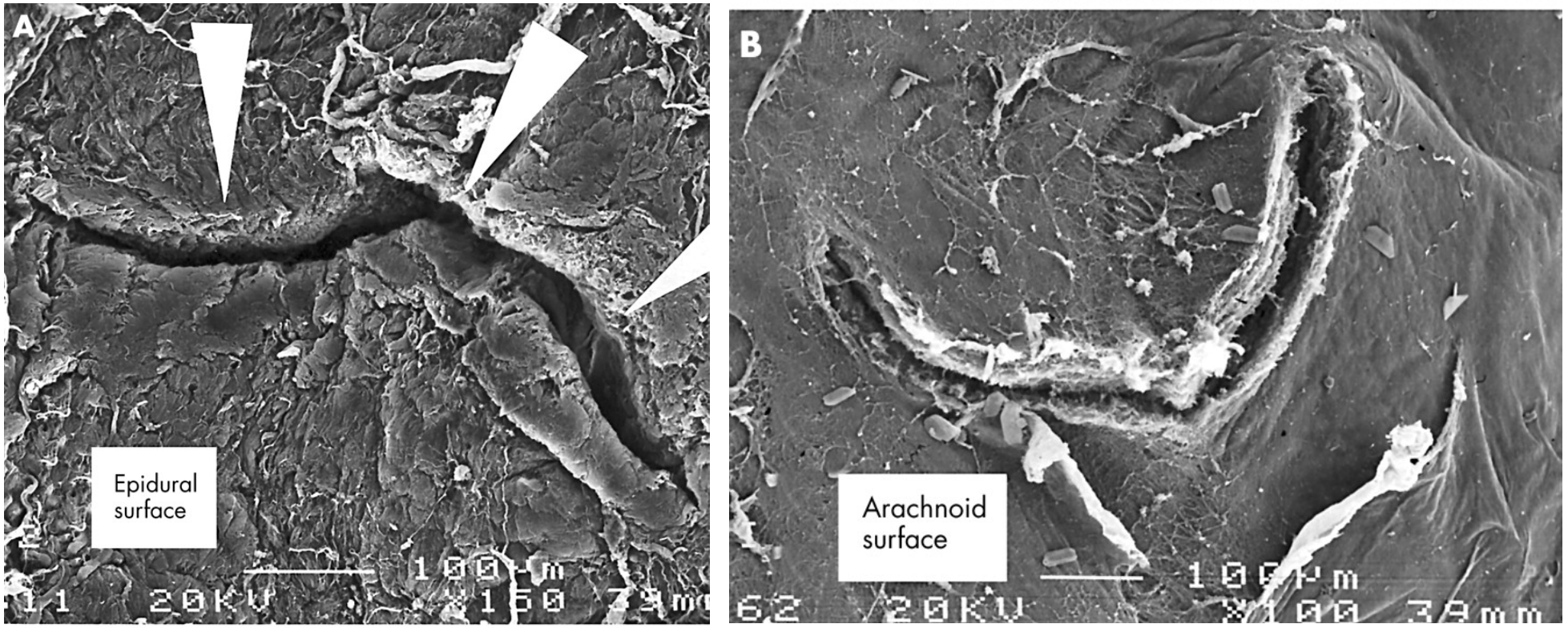


Figure 3

Dura-arachnoid lesion caused by a 22 gauge Quincke needle introduced with the bevel perpendicular to the axis of the spinal cord. (A) Epidural surface of the dural sac. Scanning electron microscopy ×150. Bar: 100 microns. (B) Arachnoid surface of the dural sac. Scanning electron microscopy ×100. Bar: 100 microns.

Reina et al. J Neurol Neurosurg Psychiatry. 2004

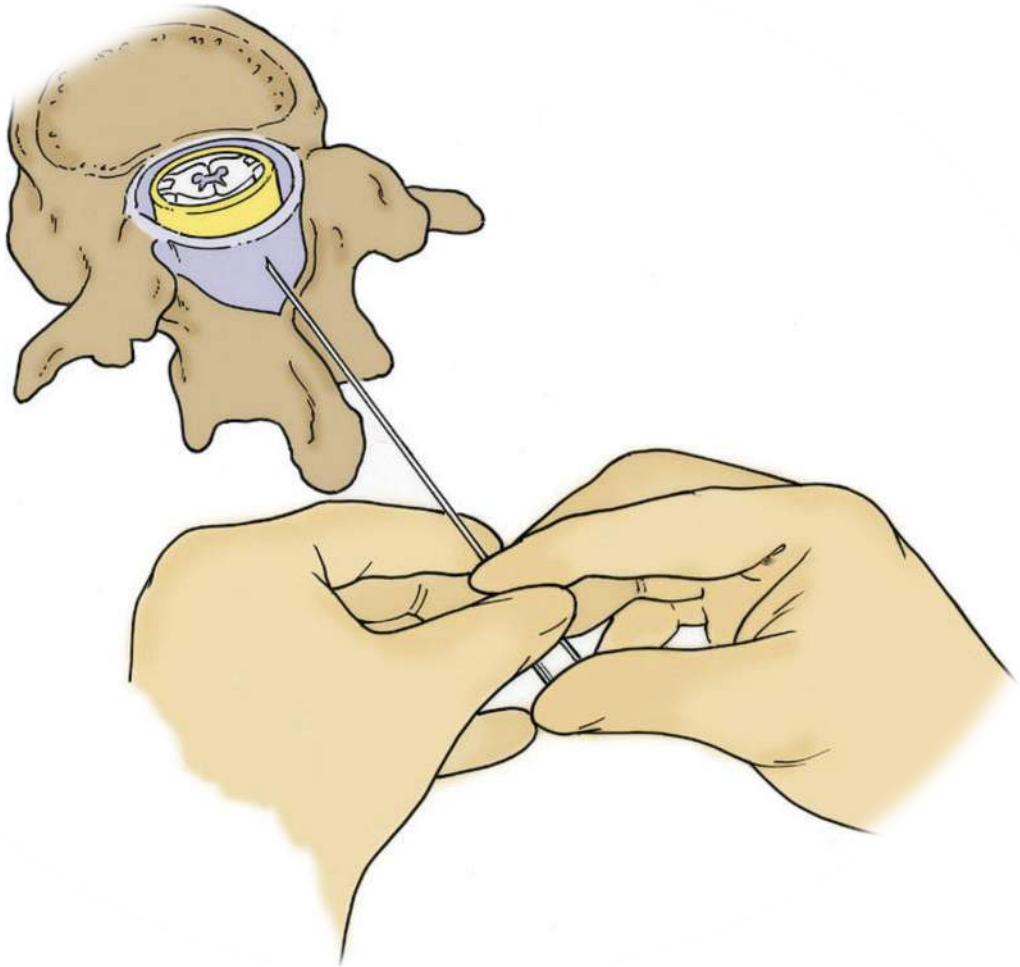
Risk factors

- Female sex
- Younger age (31-50y)
- History of PDPH

Table 4. Procedural Characteristics Associated With PDPH

Factor	Statement	Level of certainty
Needle type	Compared with cutting needles, noncutting spinal needles are associated with decreased PDPH risk.	High
	There is limited evidence regarding a particular design of noncutting spinal needle and the risk of PDPH.	Low
Needle size	When using cutting needles, narrower-gauge needles reduce the risk of PDPH.	High
	For noncutting needles, limited evidence suggests narrower-gauge needles reduce the risk of PDPH.	Moderate
Needle advancement	Evidence is insufficient to confirm benefit of any technique used to identify the epidural space on reduction of the incidence of PDPH.	Low
No. of attempts	Evidence suggests an association between the number of attempts and the risk of PDPH.	Moderate
Operator experience	Evidence suggests that a higher level of operator experience level reduces the incidence of PDPH, but the net benefit may be small.	Moderate
Level of neuraxial block	Evidence does not suggest an association of PDPH with the level of epidural insertion.	Moderate
Patient position	Evidence suggests a lower risk of PDPH with techniques performed with the patient in the lateral decubitus position.	Moderate
Traumatic vs atraumatic tap	Evidence suggests that the choice of needle for LP does not alter the risk of traumatic tap and the risk of PDPH.	Moderate

Uppal et al., Reg Anesth Pain Med. 2024, Weji et al. Perioperative Medicine 2020



Post-dural puncture headache - PDPH

- within 5 days of a lumbar puncture
- remits spontaneously within 2 weeks
- remits upon blood patching

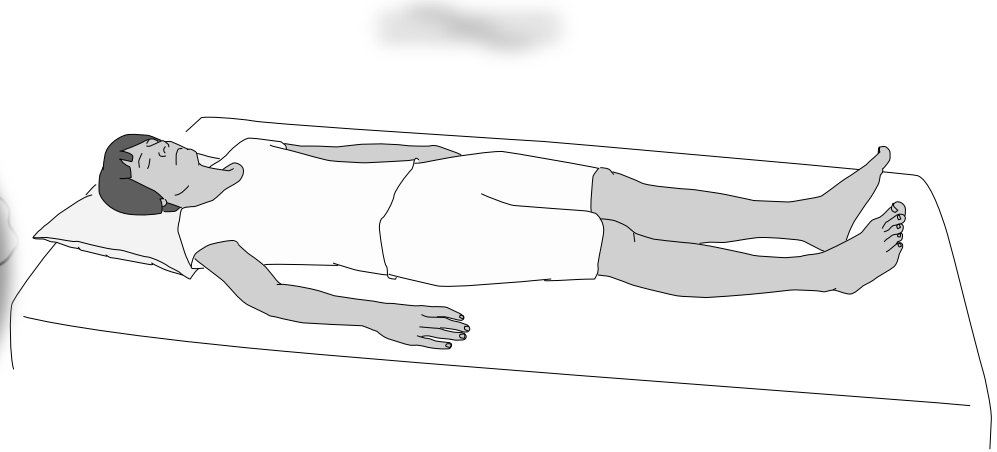
chronic PDPH ?

ICHD-3: The International Classification of Headache Disorders 3rd edition. Cephalalgia 2023

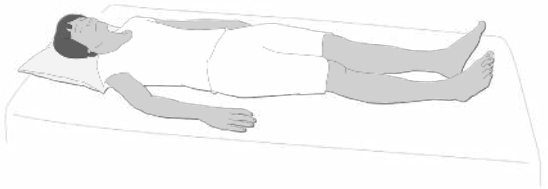
Post
Dural
Puncture
Headache

≠

Spontaneous
Intracranial
Hypotension



Symptoms of chronic post dural-puncture headache (cPDPH)



Pain

- Orthostatic Headaches
- Neck Stiffness/Pain
- Meningeal signs
  - Photophobia
  - Phonophobia

Sensory Symptoms

- Vestibulocochlear signs
  - Tinnitus
  - Dizziness
  - Equilibrium troubles
- Autonomic
  - Nausea

Cognitive

- Brain Fog
- Reduced performance
- Chronic Fatigue

Emotional Related

- «Depression»
- Anxiety

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Chronic PDPH – benign ?

”I lost my job”

“My condition has completely changed my life”

“I lost 2 years of my life in social isolation”

”I lost my partner”

“I lost my joie-de-vivre”

“No restaurant, no cinema, no reading”

- Orthostatic headache

- Fatigue
- Loss of QOL
- Depression

Acute

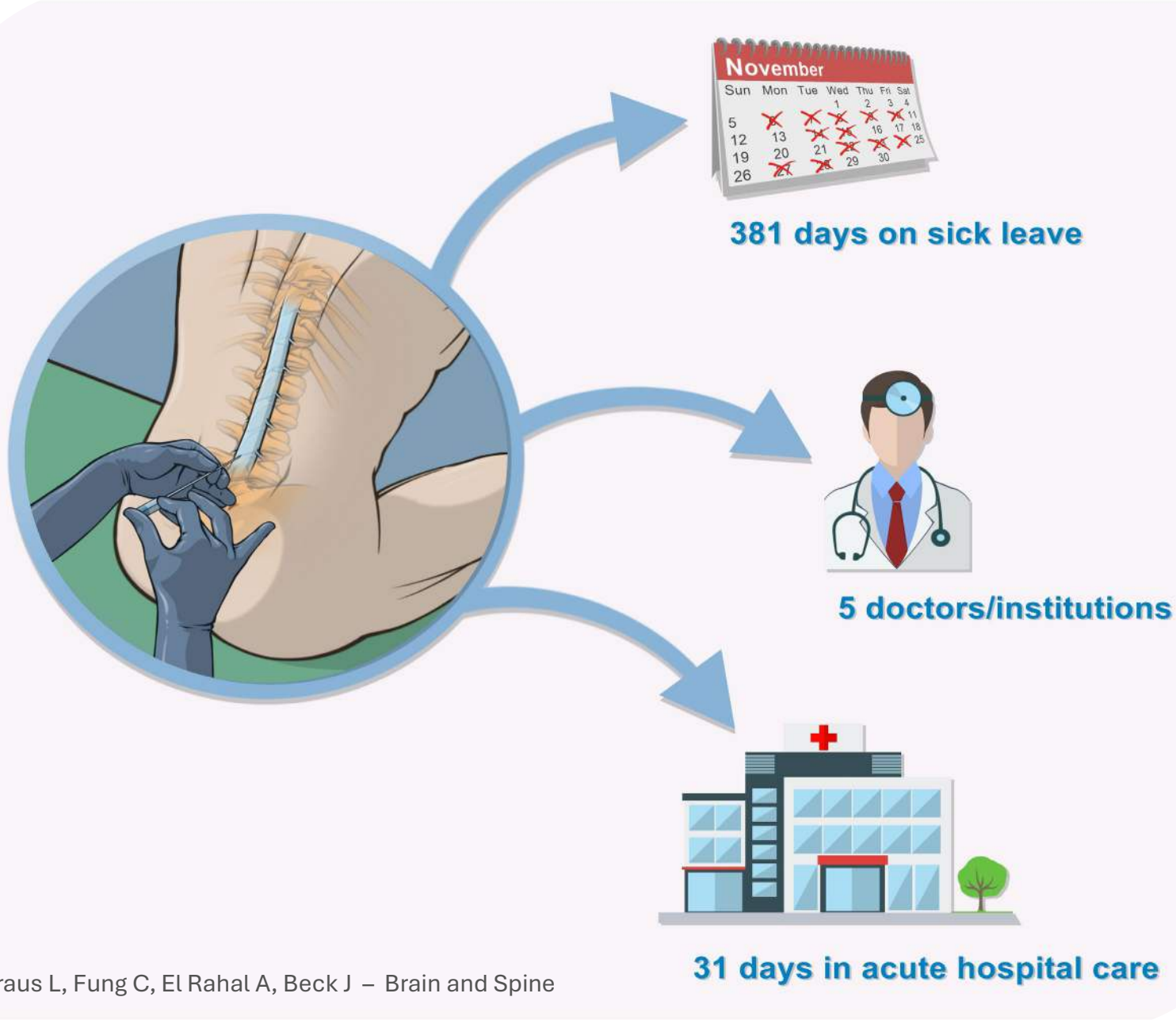
Chronic

Long Term

Lumbar Puncture

Chronic PDPH

- n = 61 patients
- Neurosurgery Freiburg



Kraus L, Fung C, El Rahal A, Beck J – Brain and Spine

RESEARCH Open Access

Health-related quality of life, work ability and disability among individuals with persistent post-dural puncture headache

Ali Kapan[1*], Thomas Waldhör[2], Tobias Schiffler[1], Jürgen Beck[3] and Christian Wöber[4,5]

Sick leave due to pPDPH

3–6 Months	14 (7.8)
6–12 Months	43 (24.0)
Over 1 year	64 (35.8)
Over 2 years	6 (3.4)

Ability to be in an Upright Position

Not at all	29 (16.2)
Less than 1 h	50 (27.9)
2–4 h	29 (16.2)
Most of the day	16 (8.9)
Whole day	55 (30.7)

Ability to take care of children

Not at all	20 (23.3)
Under 1 h	23 (26.7)
2–4 h	17 (19.8)
4–6 h	15 (17.4)
Whole day	11 (12.8)

Full time work in same job = 12 %

According to Kapan et al. Headache 2024

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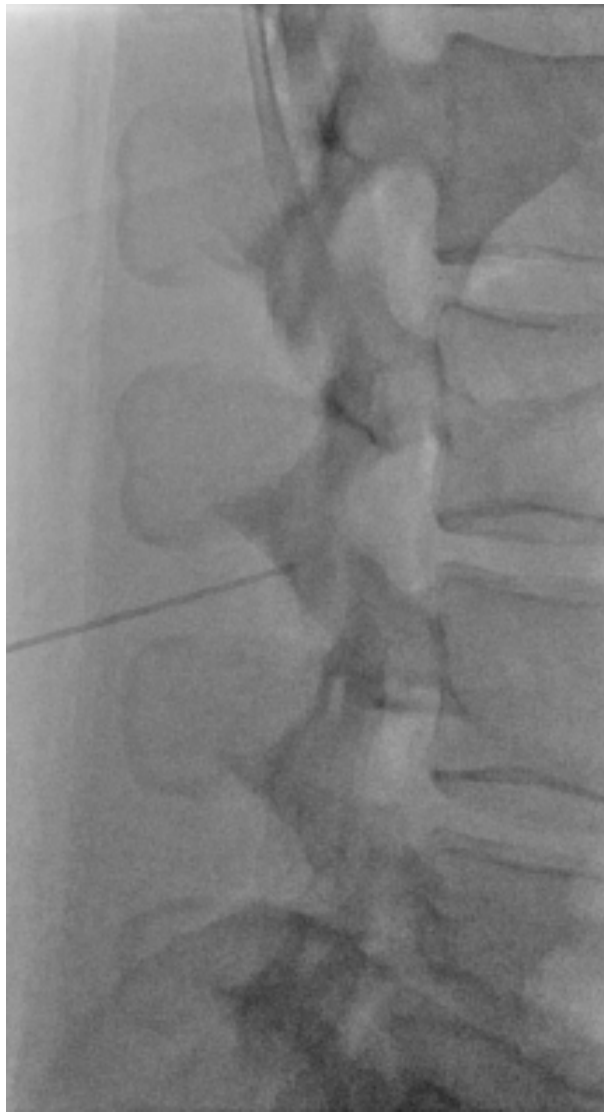
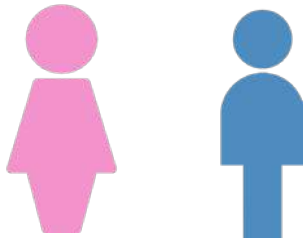


- We must document needle postion
- **with x-ray**

Follow up ?

- every lumbar puncture
- every blood patch
- every PDA, infiltration...

Results - Demographics



N= 41

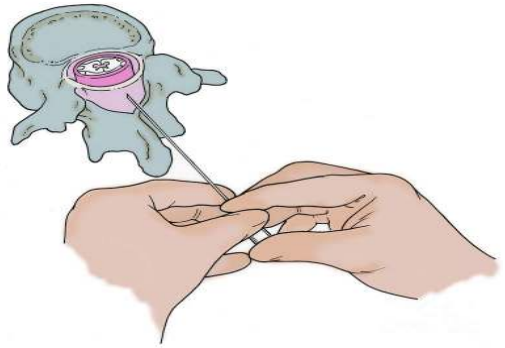
N= 31 75.6%

N= 10 24.4%

Total of levels explored N= 79

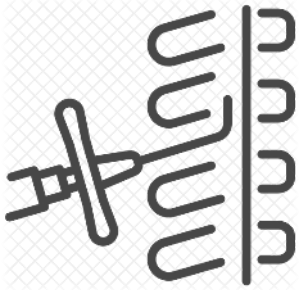
Age Median – **40.5** y.o (IQR 32-46)

Lumbar Puncture



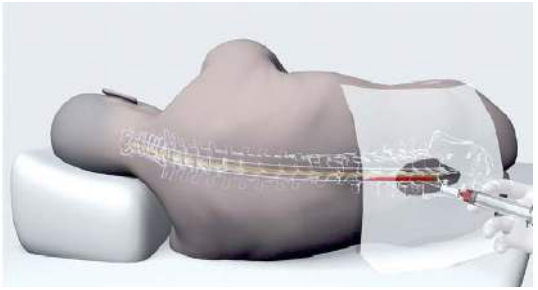
71%

UDP/PDA (Unintended dural puncture)
or
Spinal Anesthesia



27 %

EBP



Mean = 3

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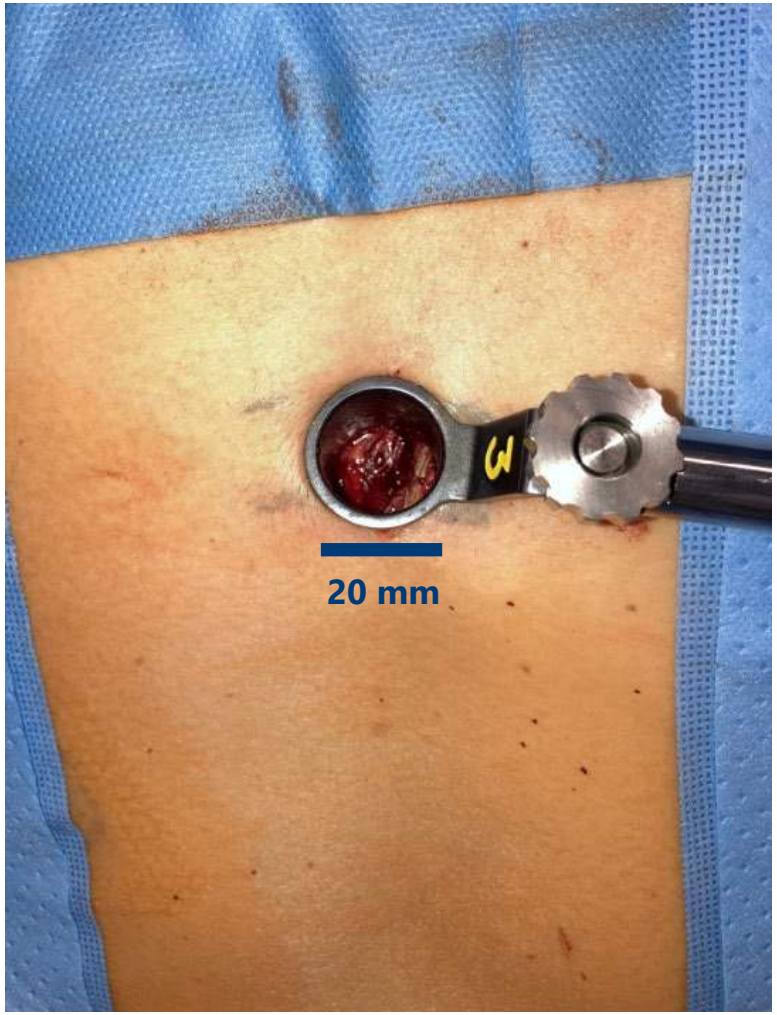
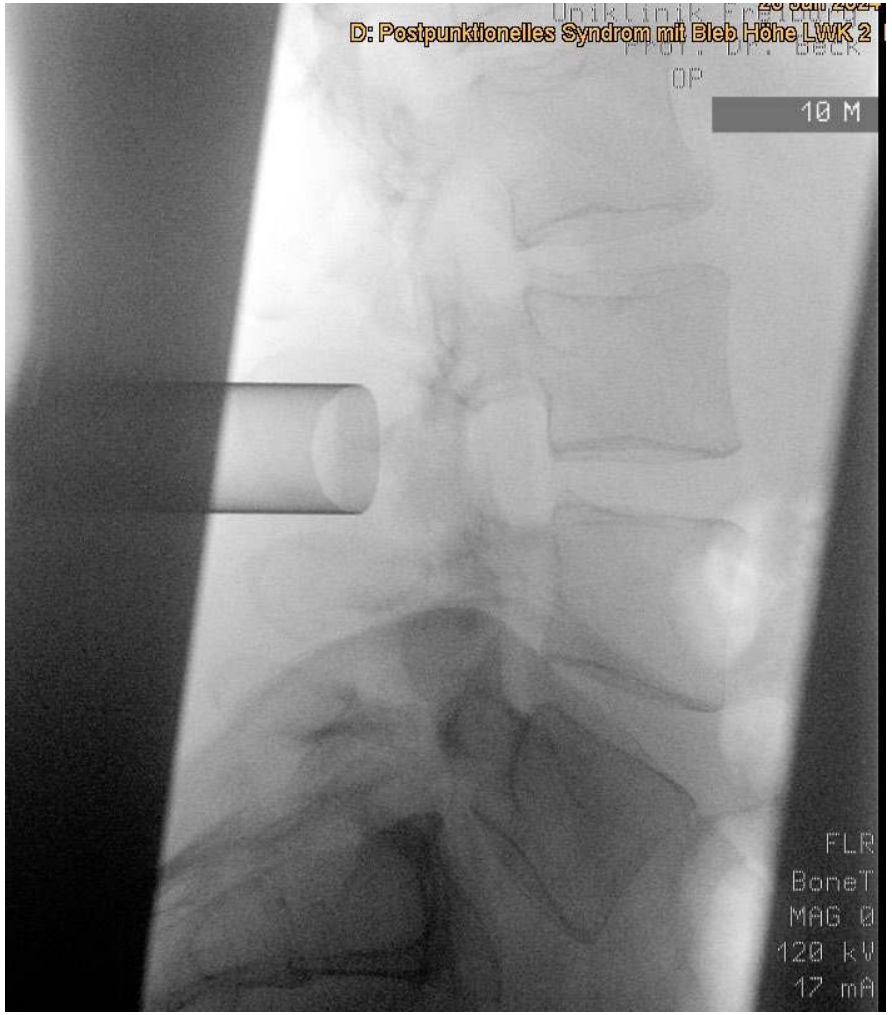
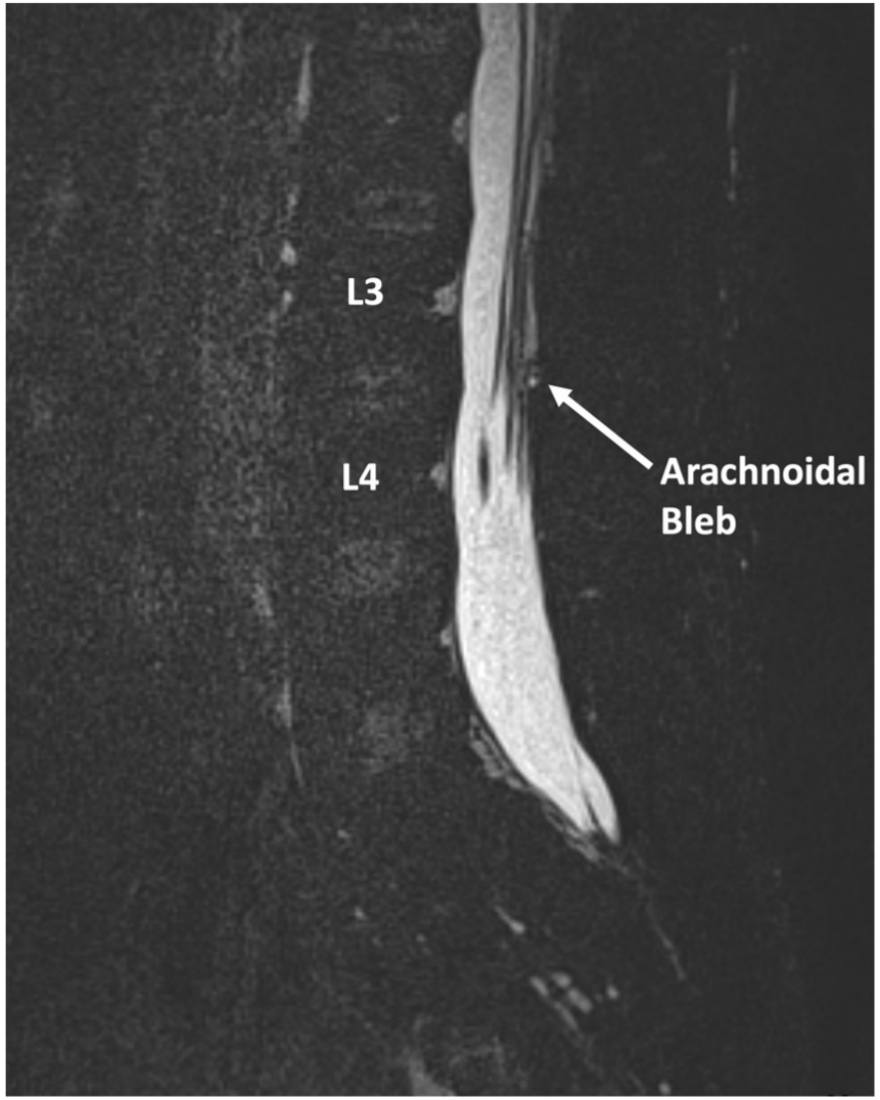
Minimal invasive surgery - **MIS** - Approach





cPDPH

Arachnoid Bleb - Weeping Dura



El Rahal A, F. Volz, Beck J et al.

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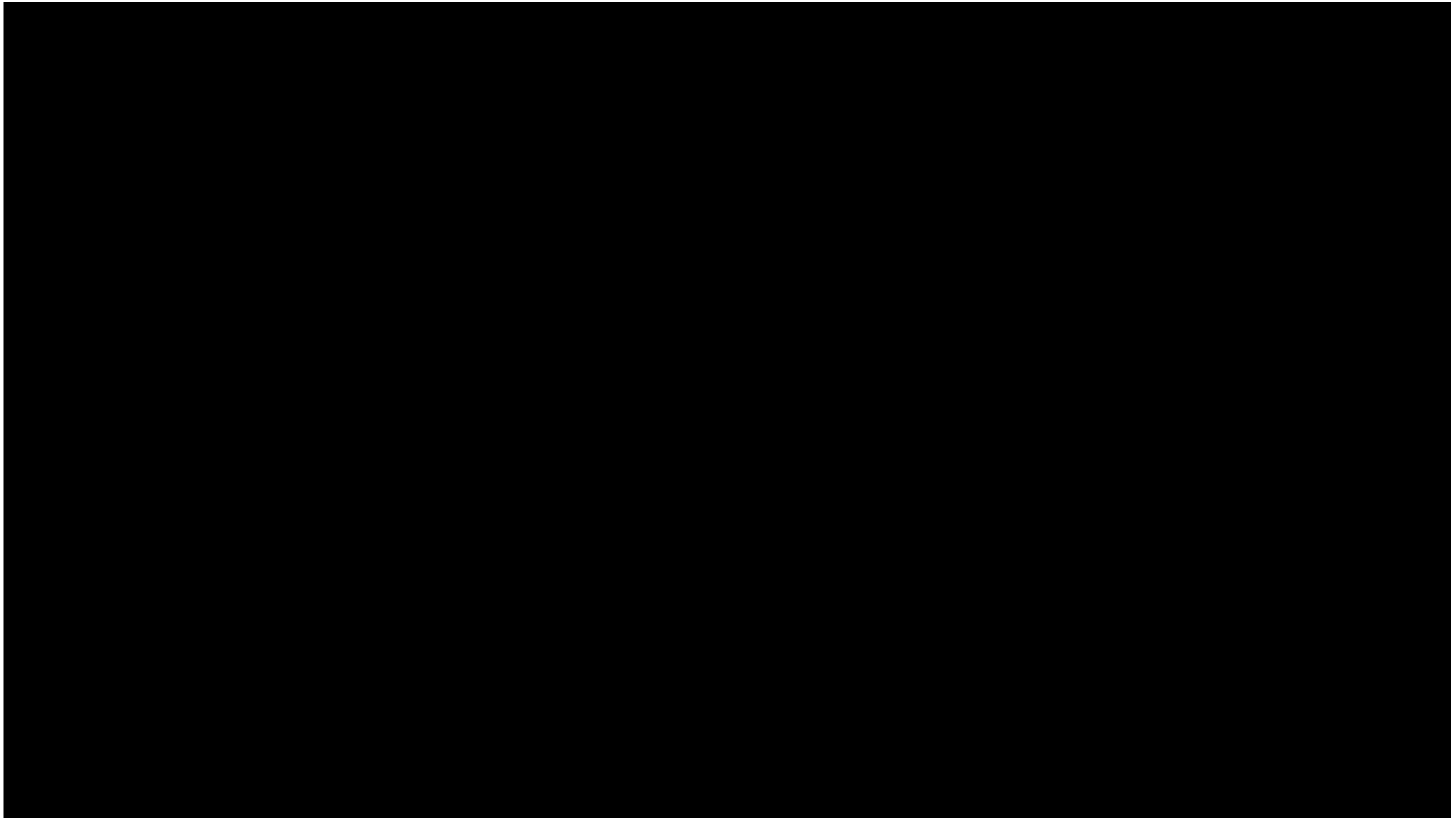
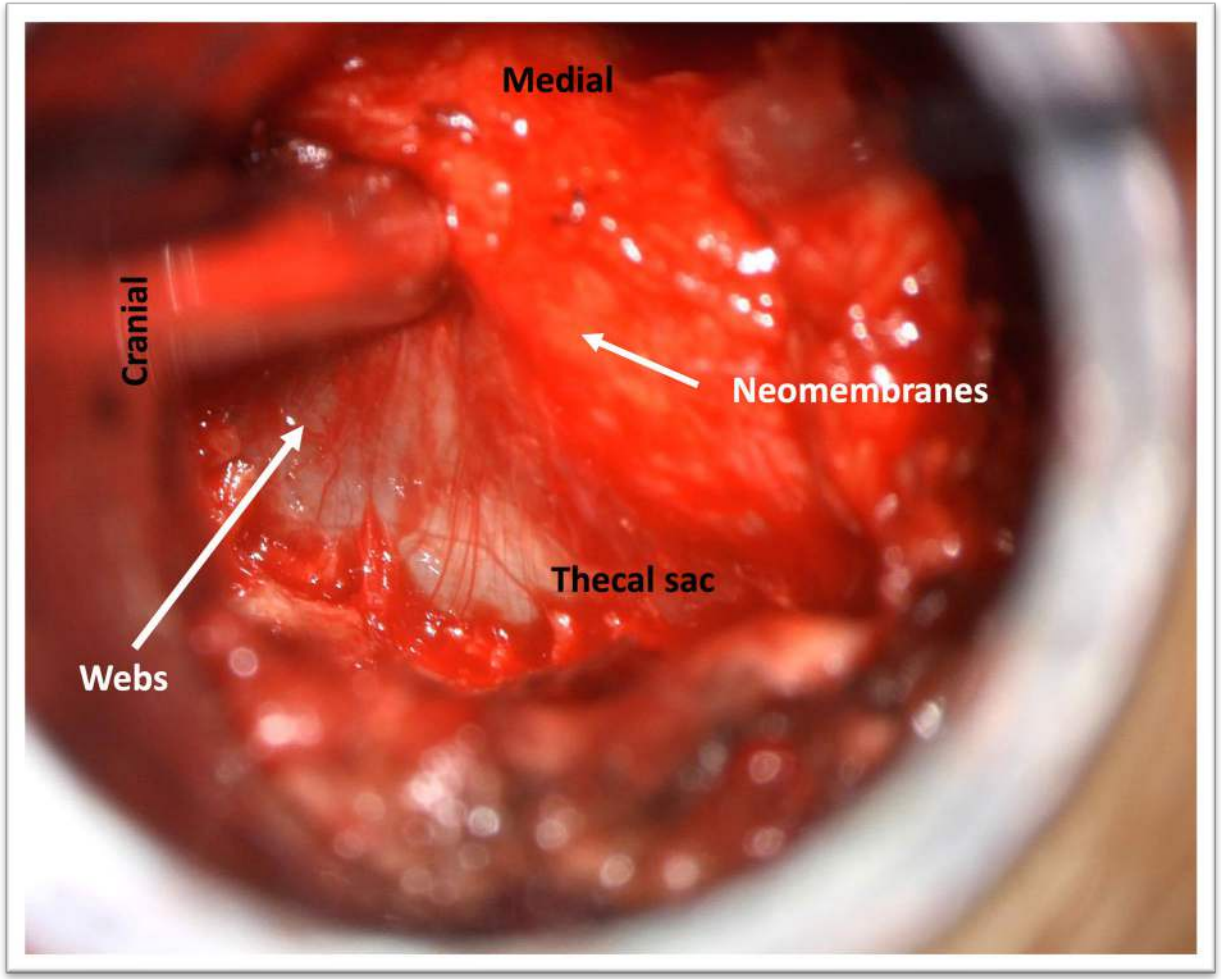
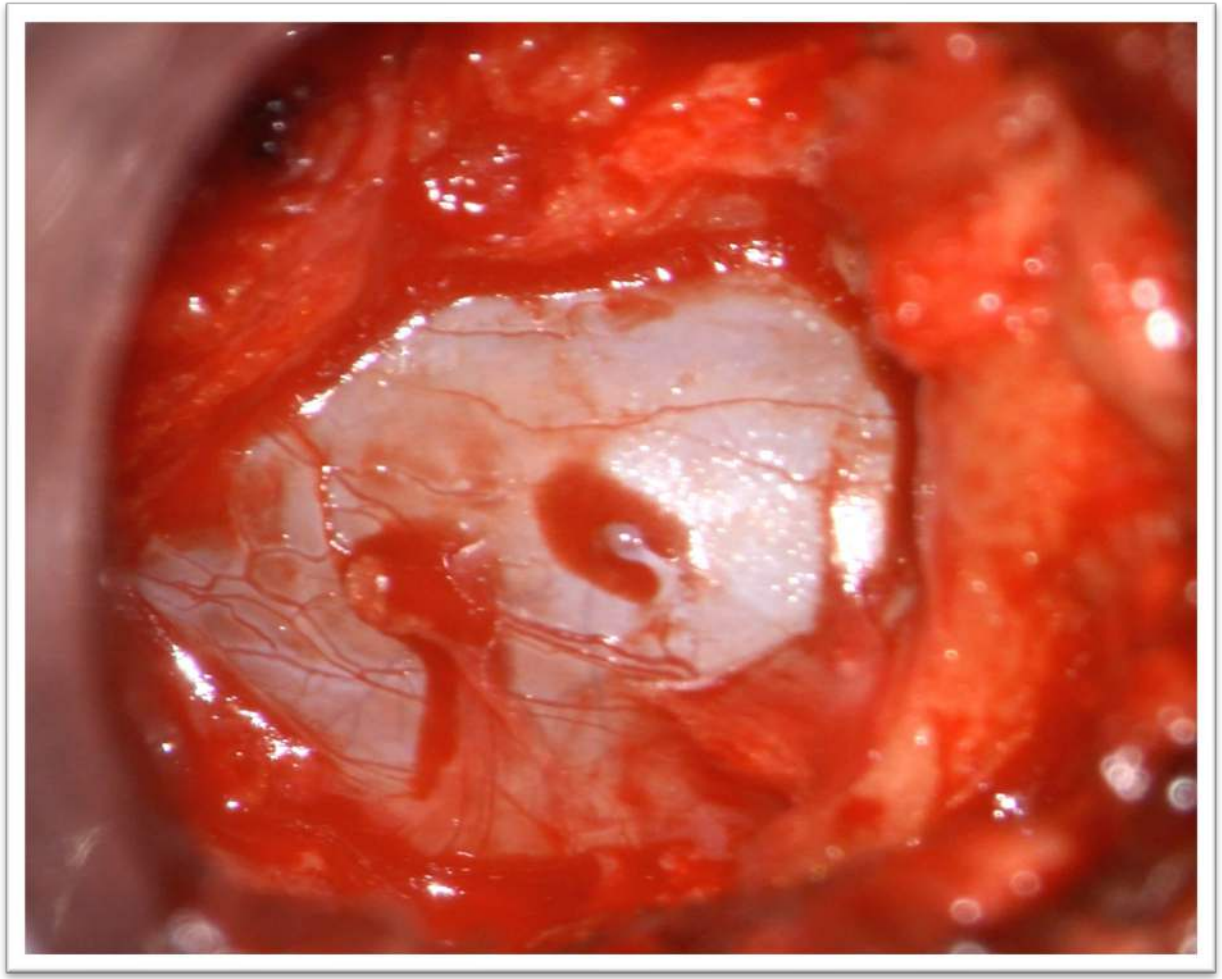
Weeping dura



Arachnoid Bleb - Weeping Dura





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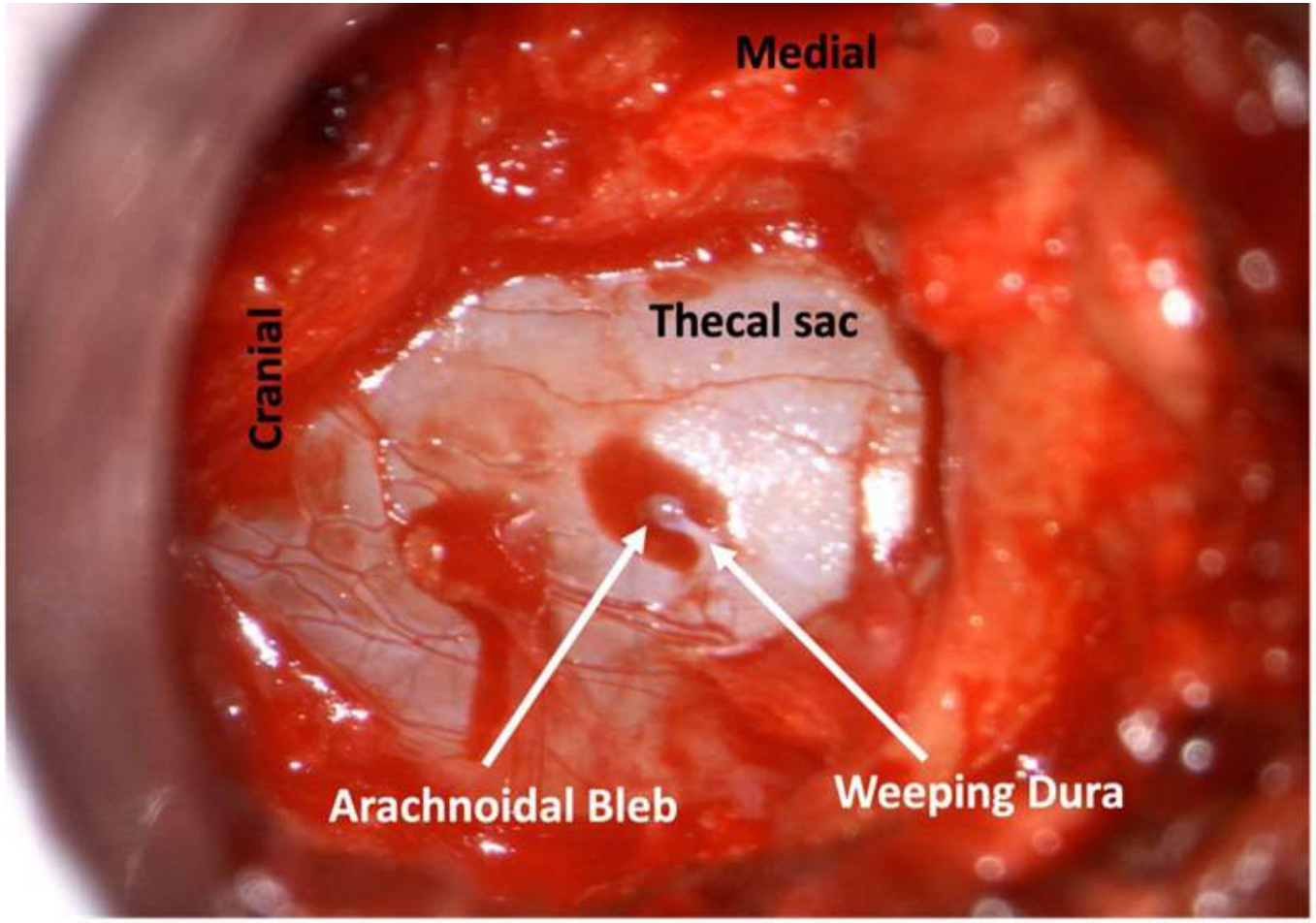
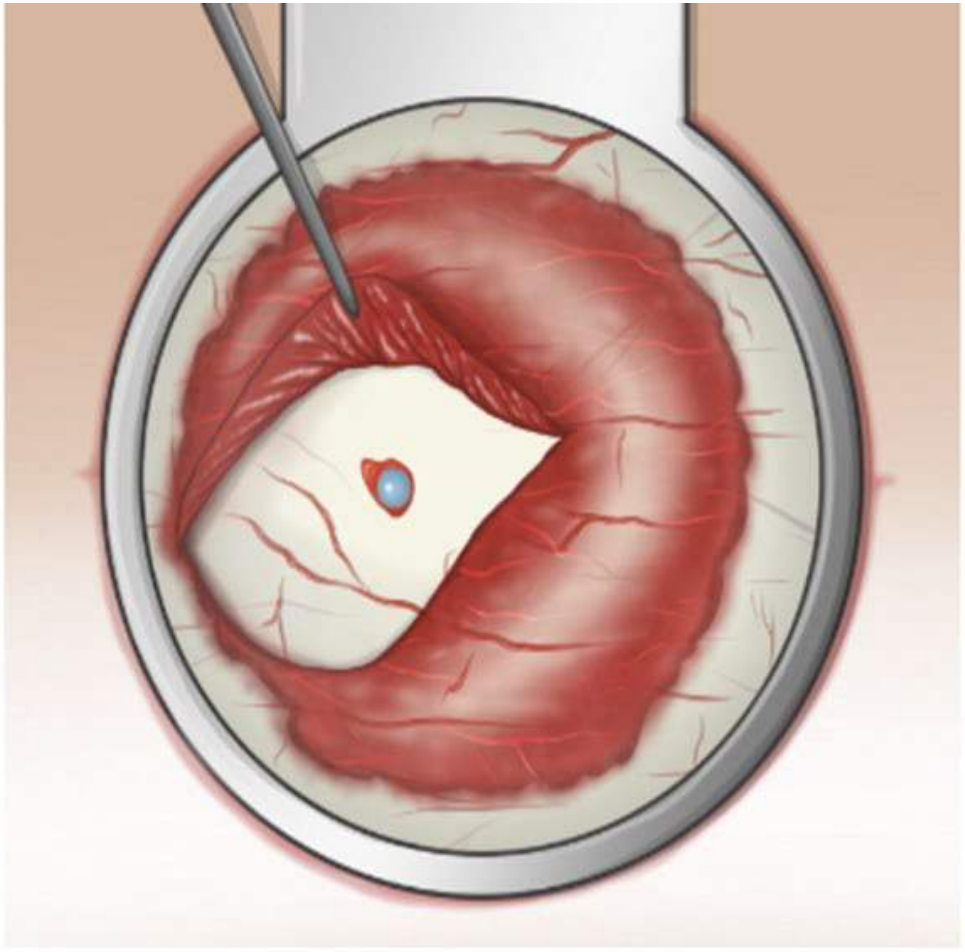
Neo-membranes and blebs





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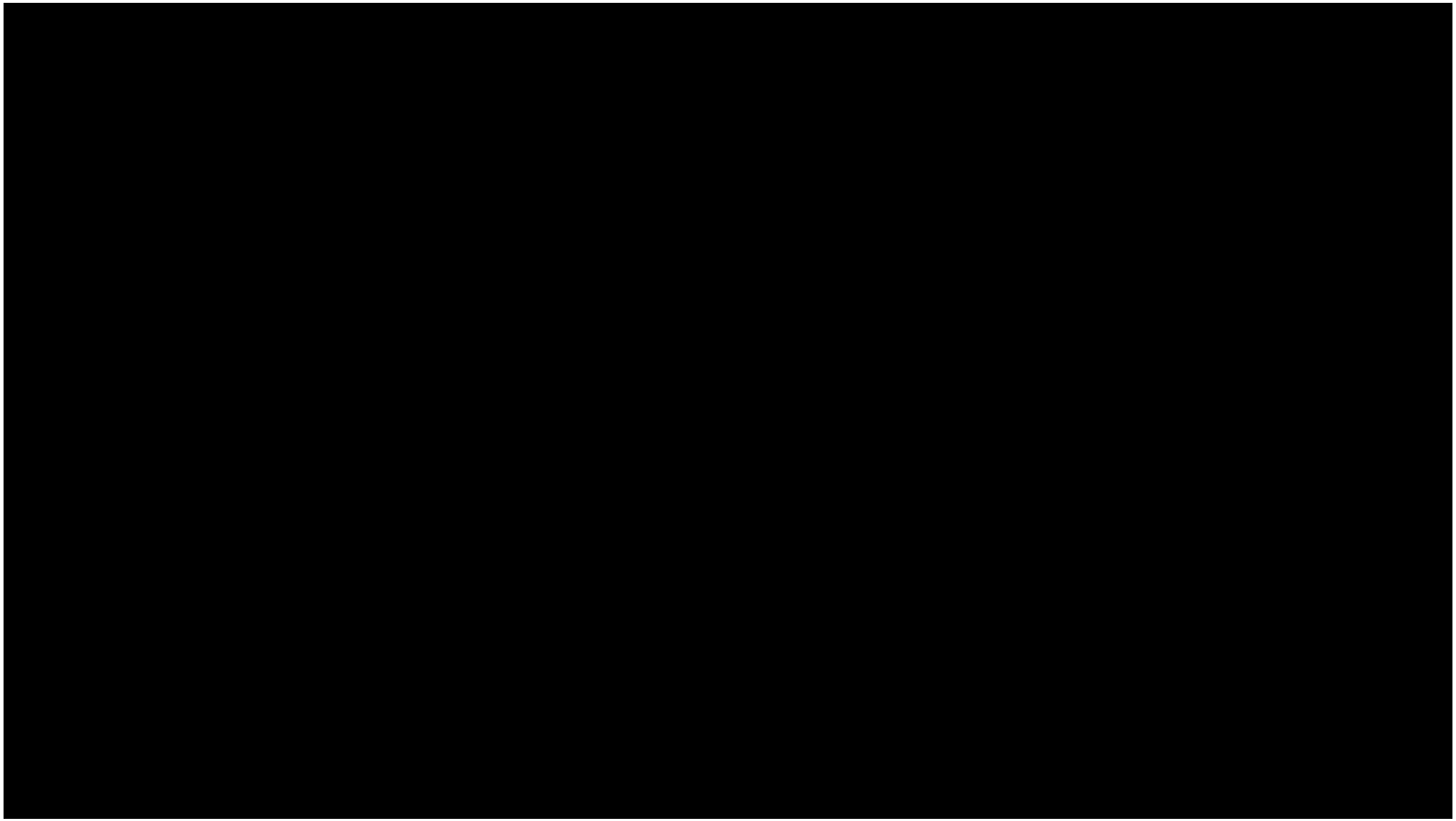
Bleb reduction and Sandwich-Suture



El Rahal, Volz, Beck et al. 2024

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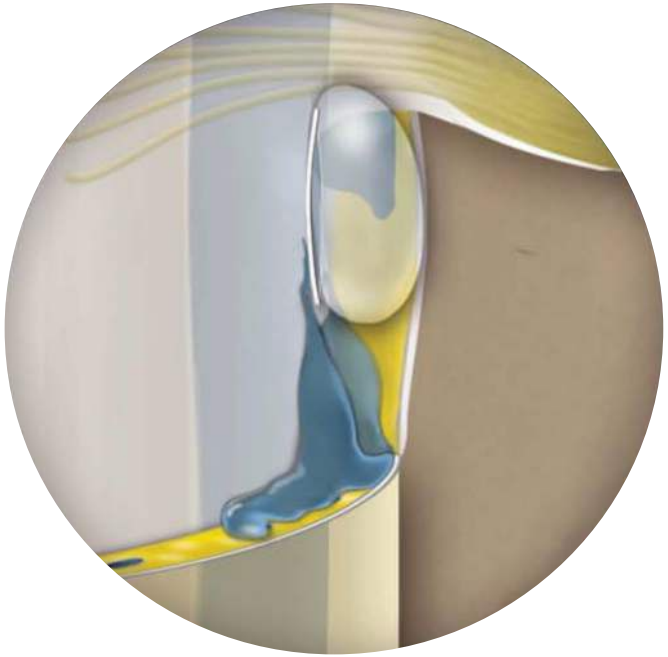
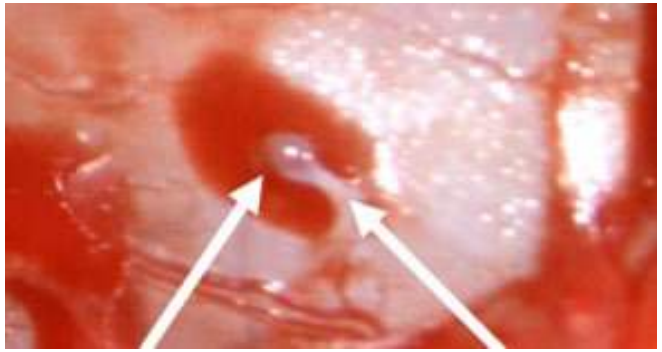
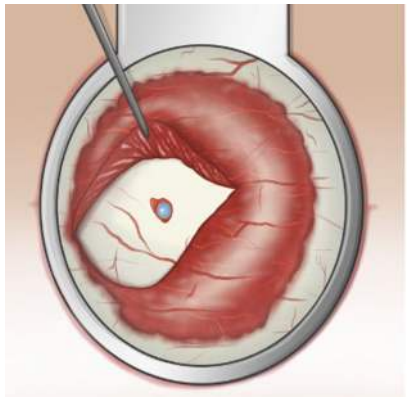
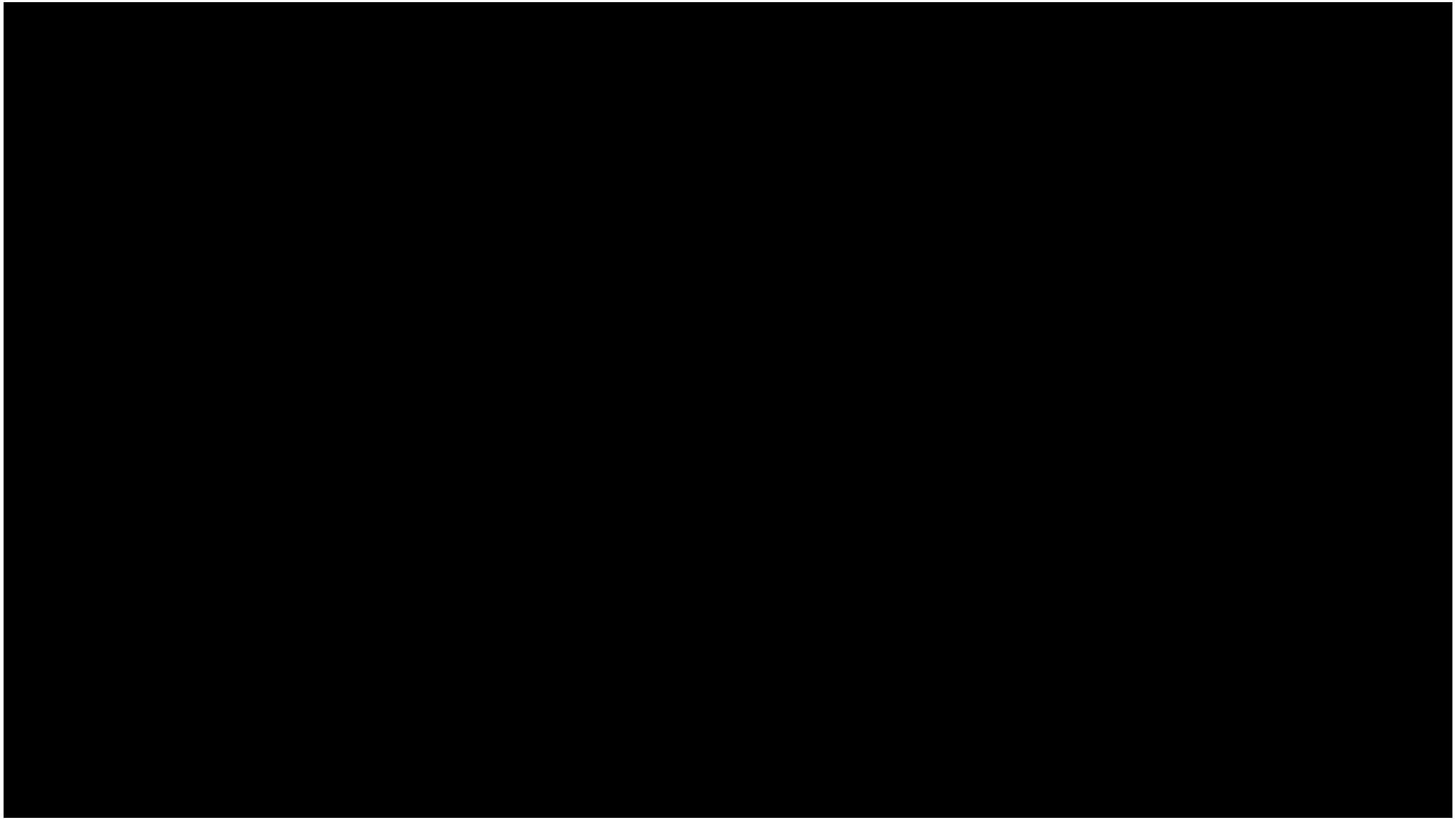
September 20, 2016
Beck et al. Neurology







cPDPH – multiple leak – clipping and 360° Patch



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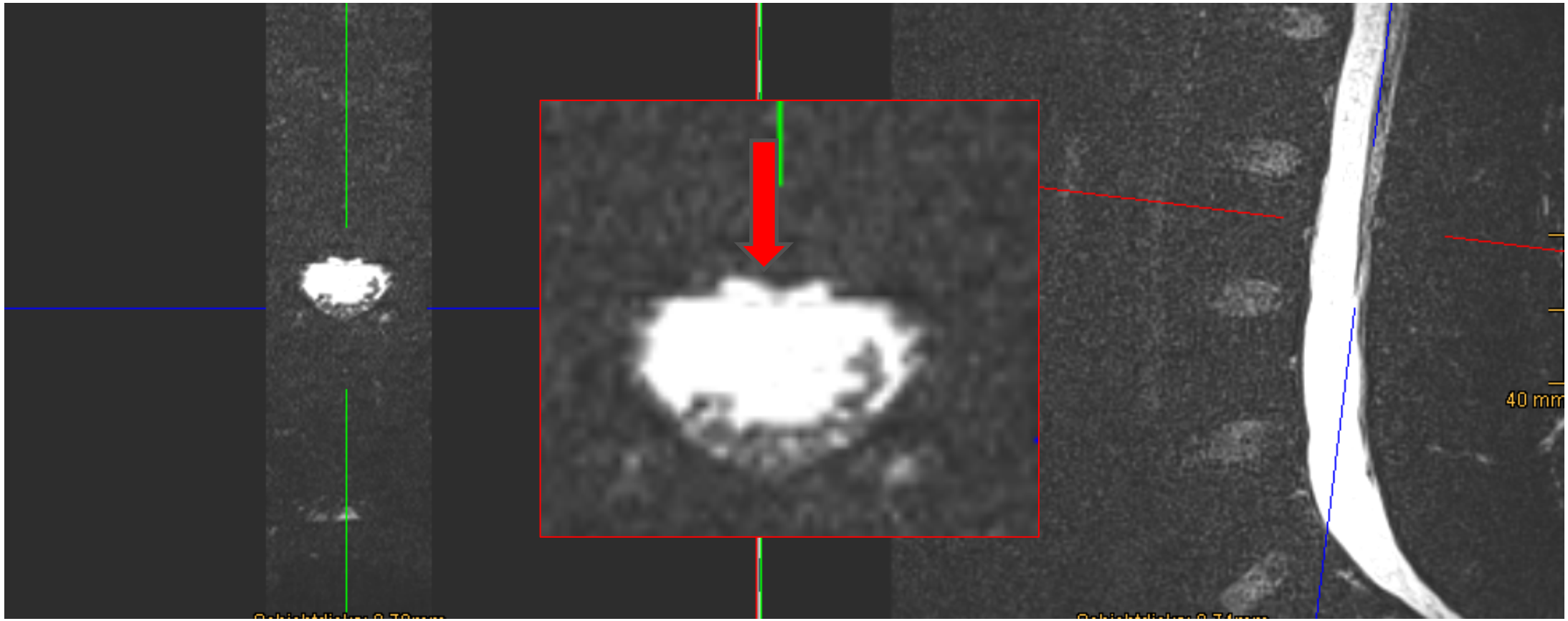
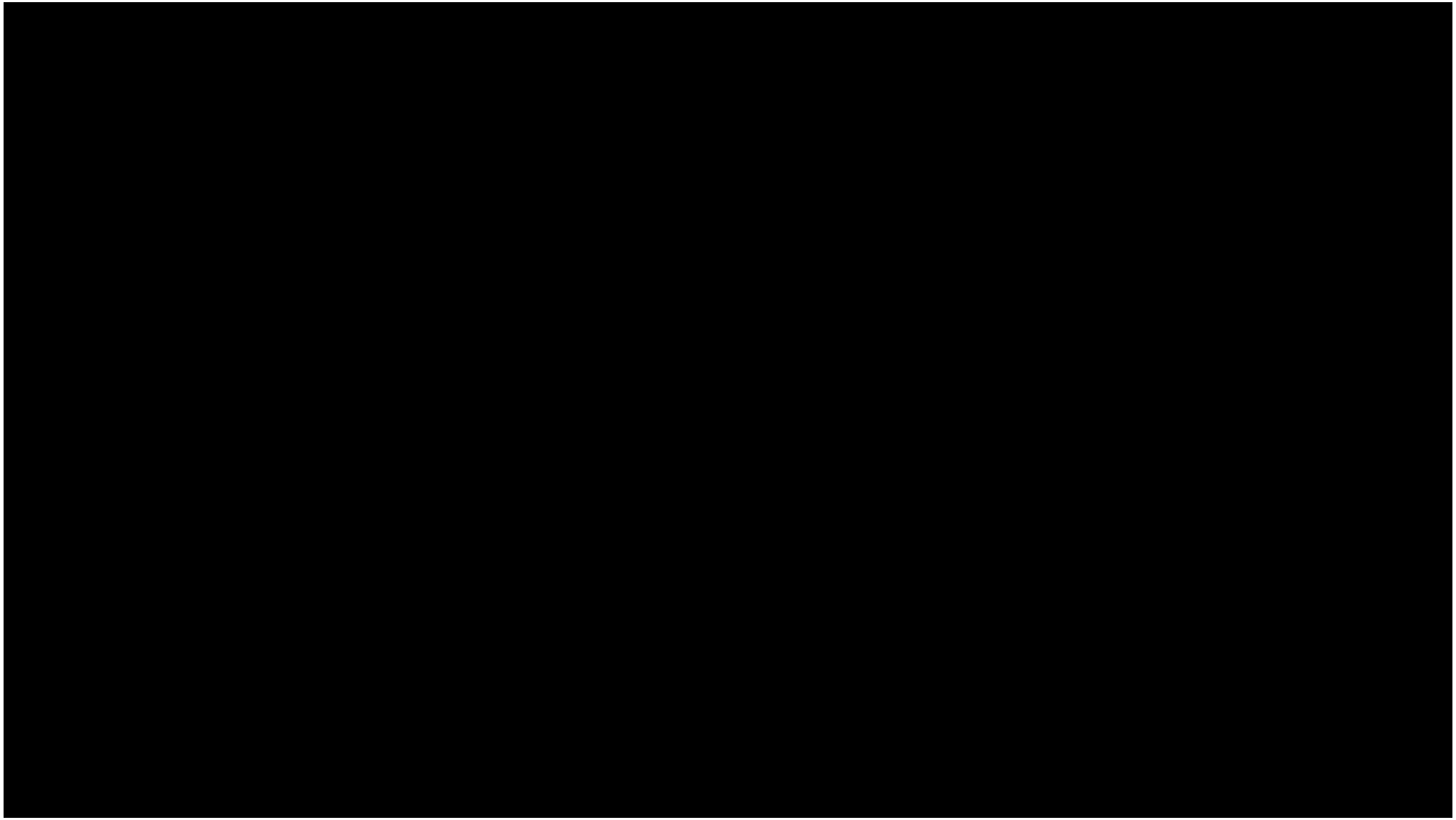
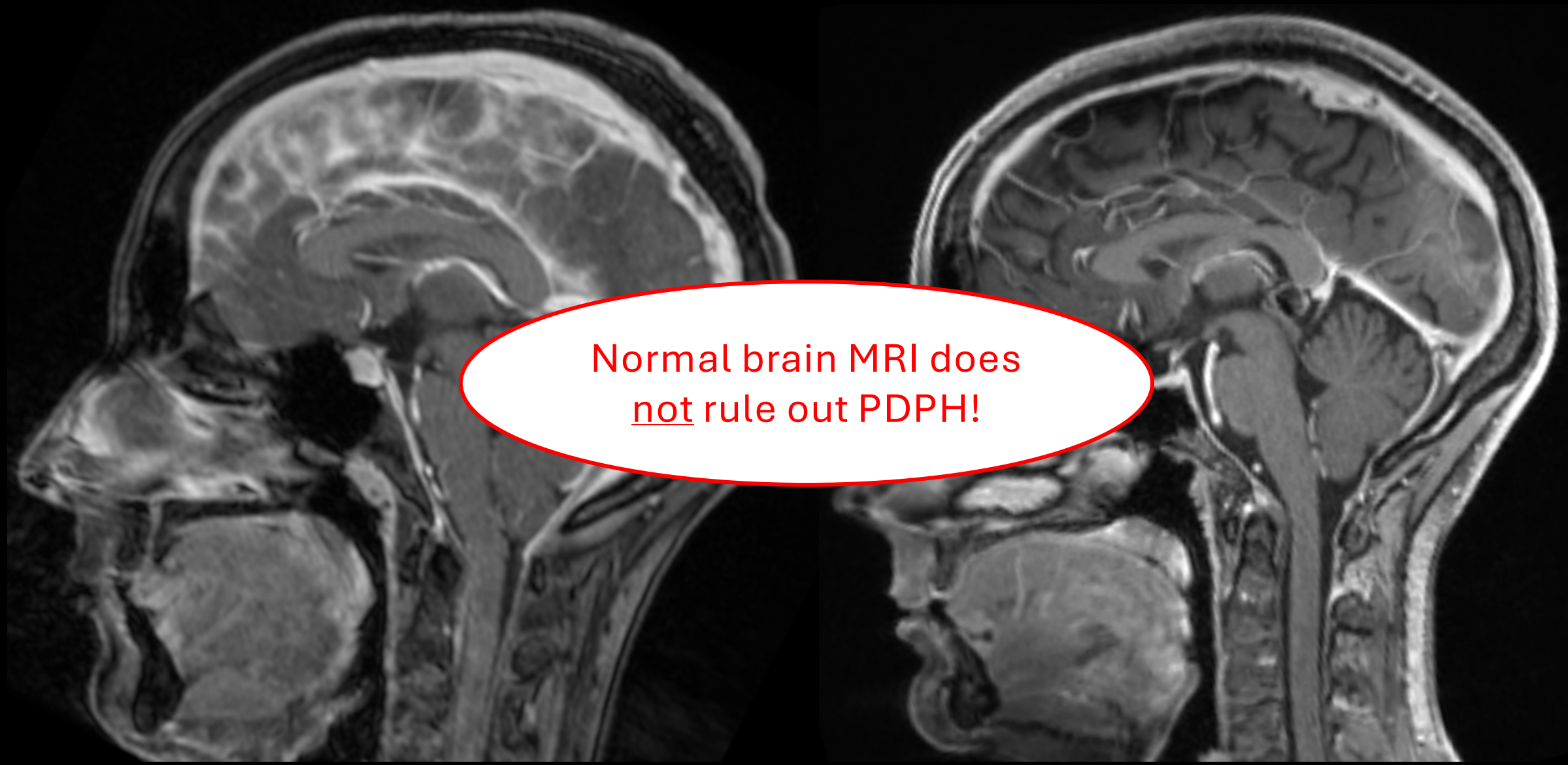

40 mm

cPDPH – transdural ventral leak



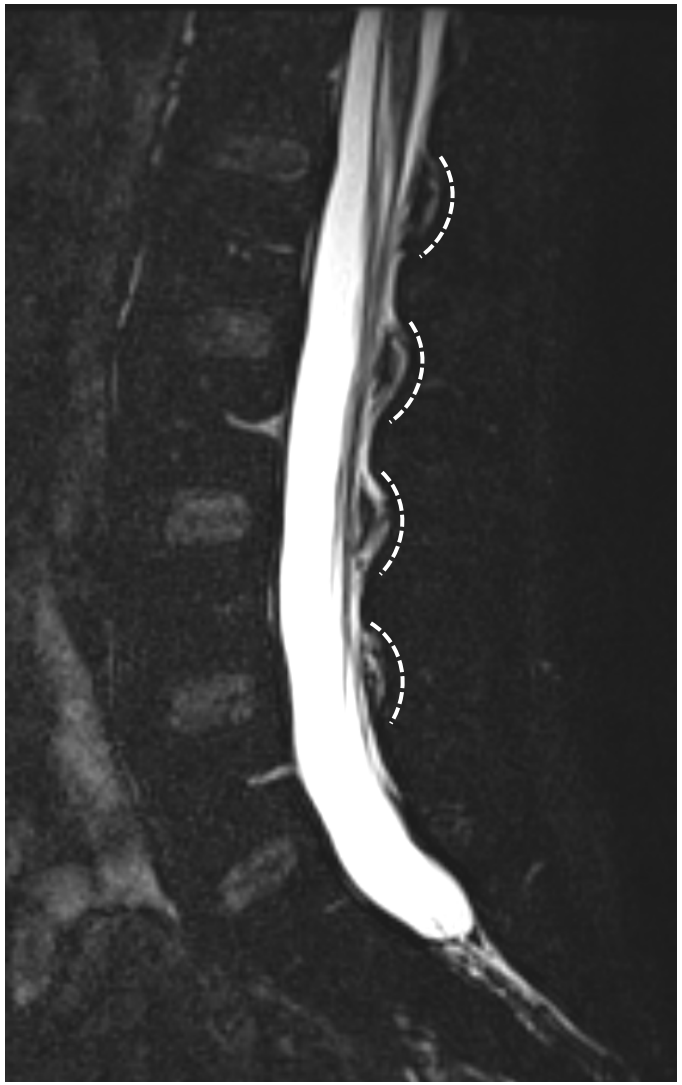


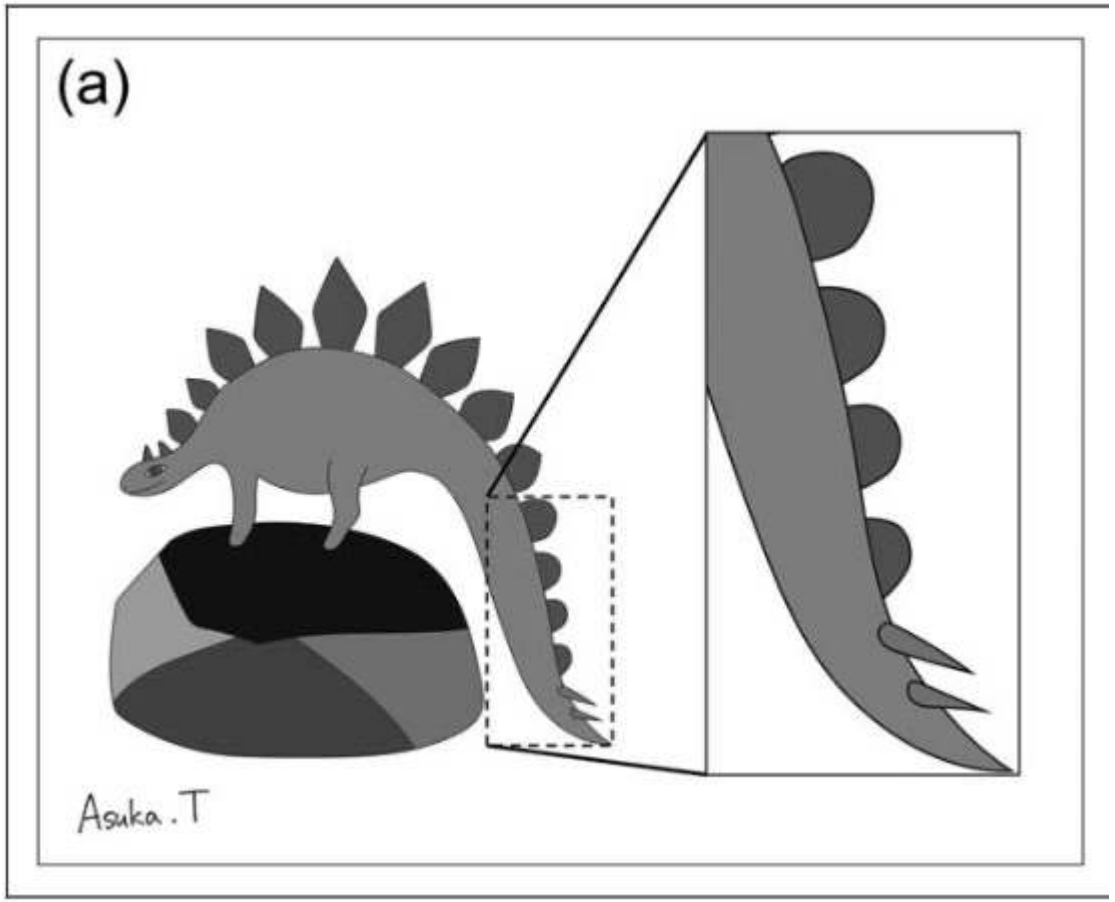
28 years, UDP while PDA

30 years, UDP while PDA

Post-dural puncture headache (PDPH)

Dinosaur tail sign



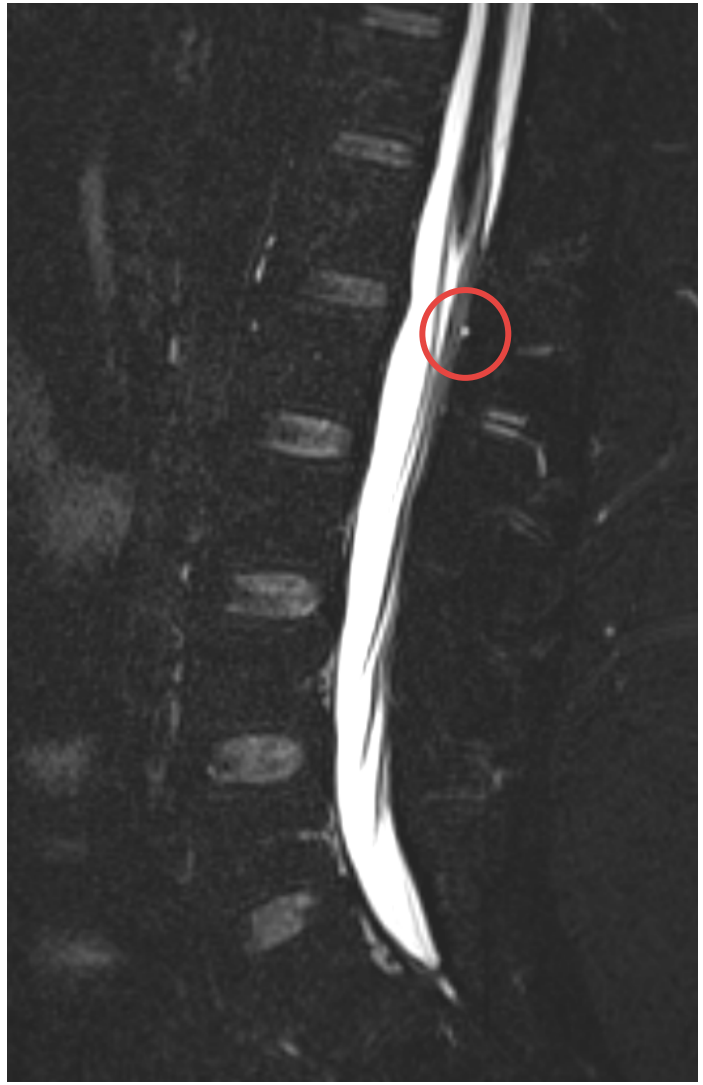


* Sakurai et al., Headache 2017

chronic Post-dural puncture headache (cPDPH)

Dinosaur tail sign

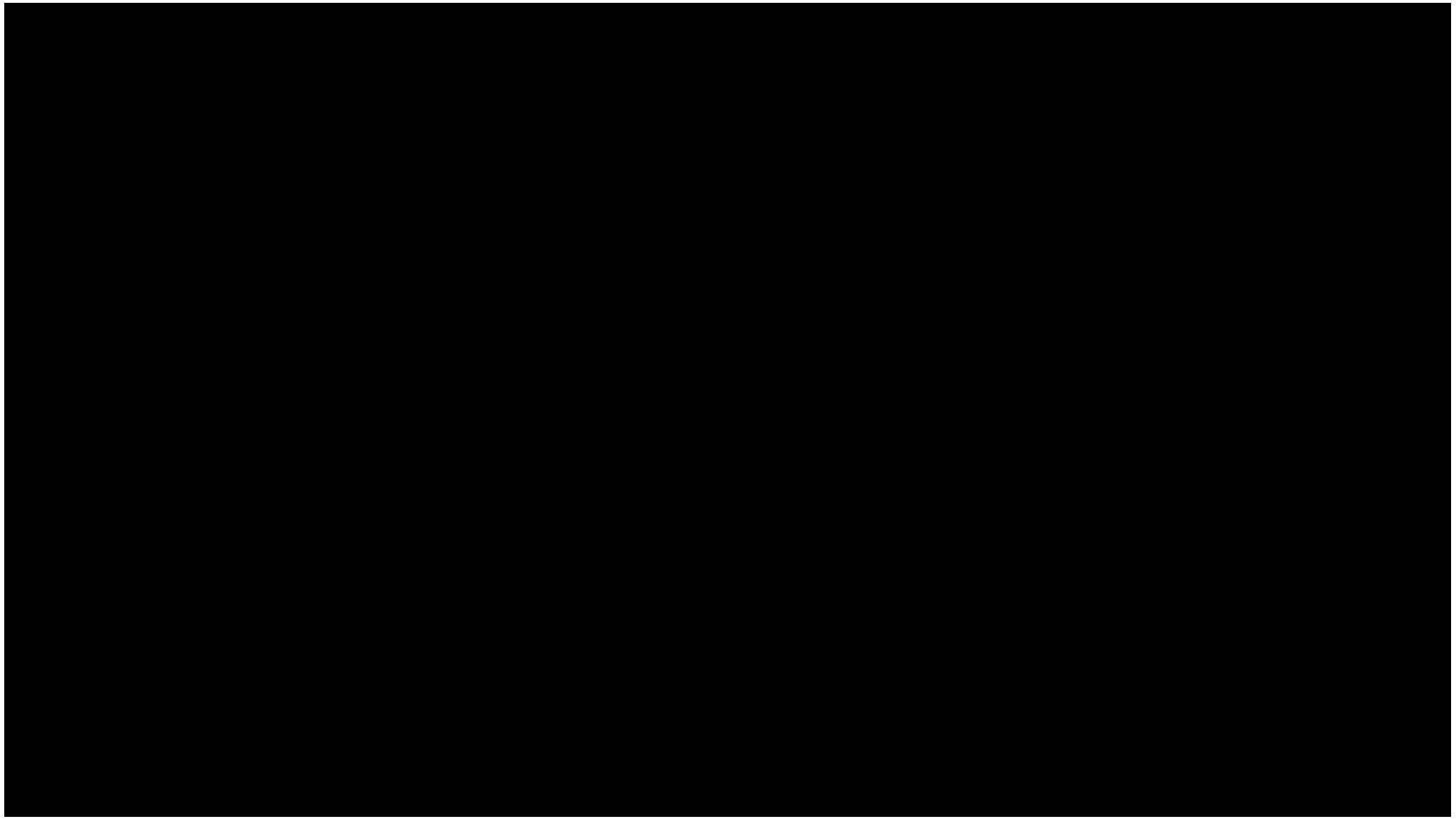
Arachnoid bleb (small)



Arachnoid bleb (big)

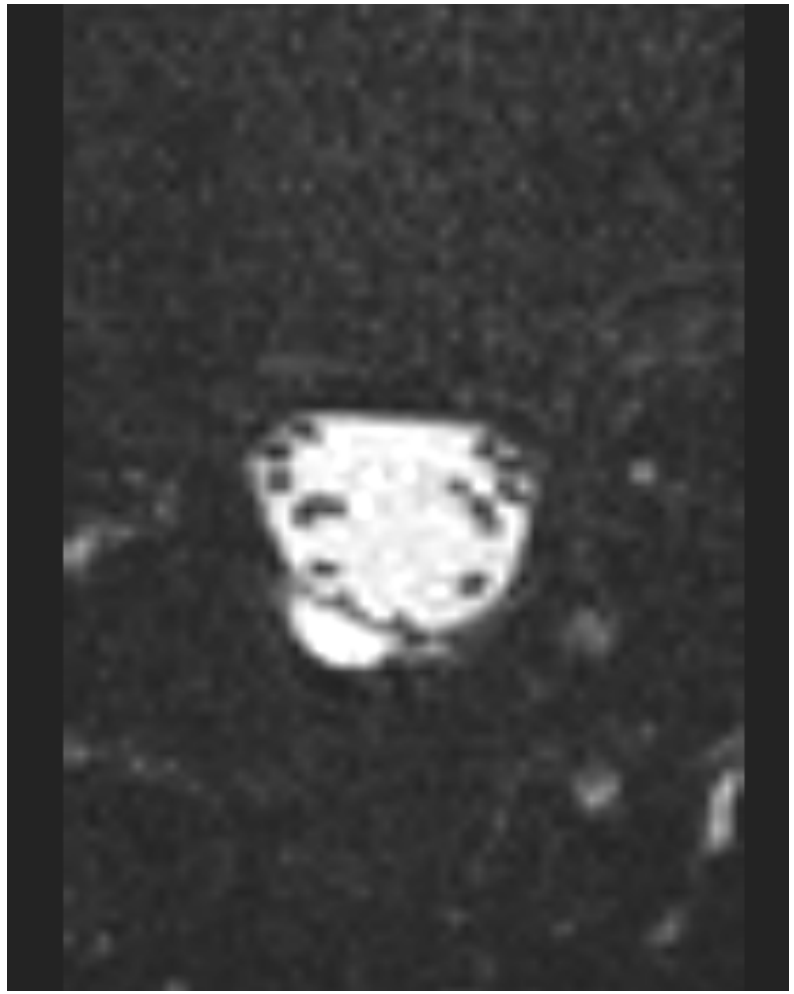
Sakurai et al., Headache 2017

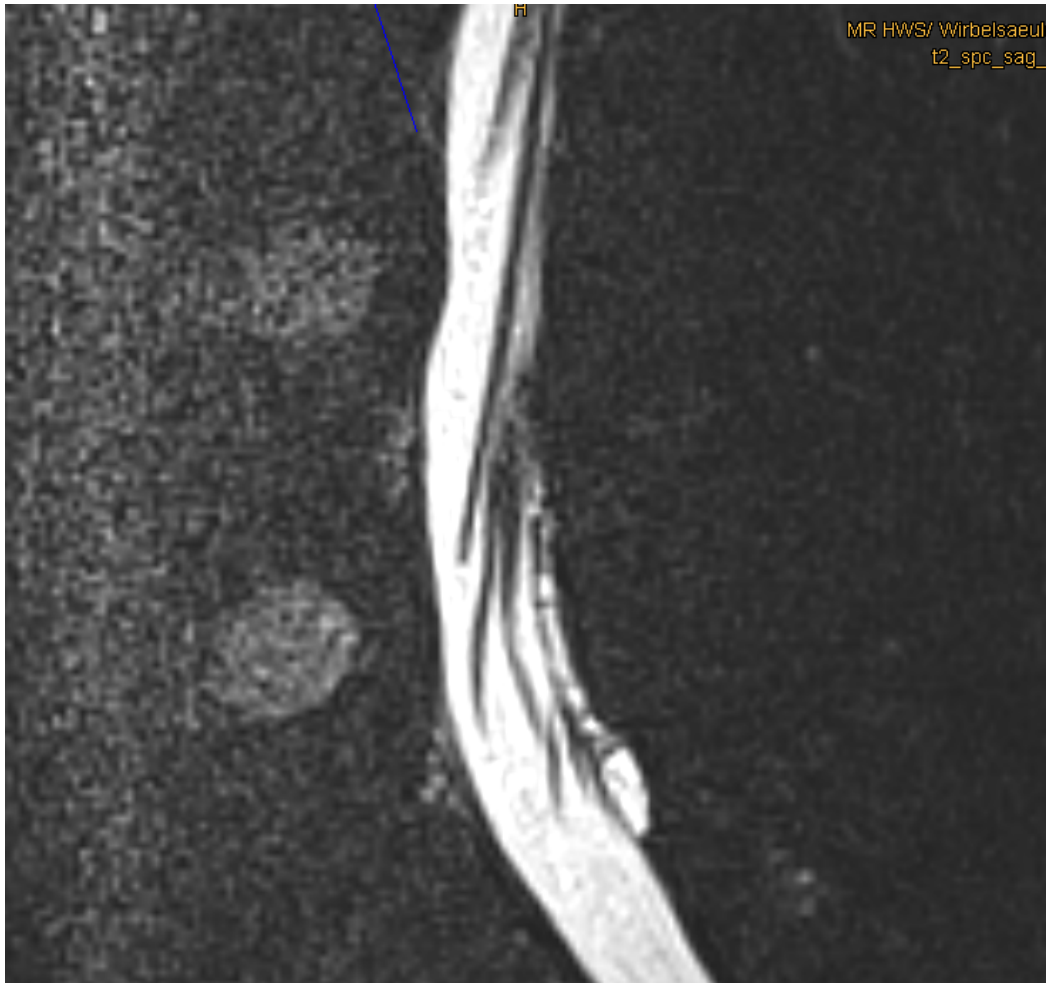
cPDPH – vein on a bleb



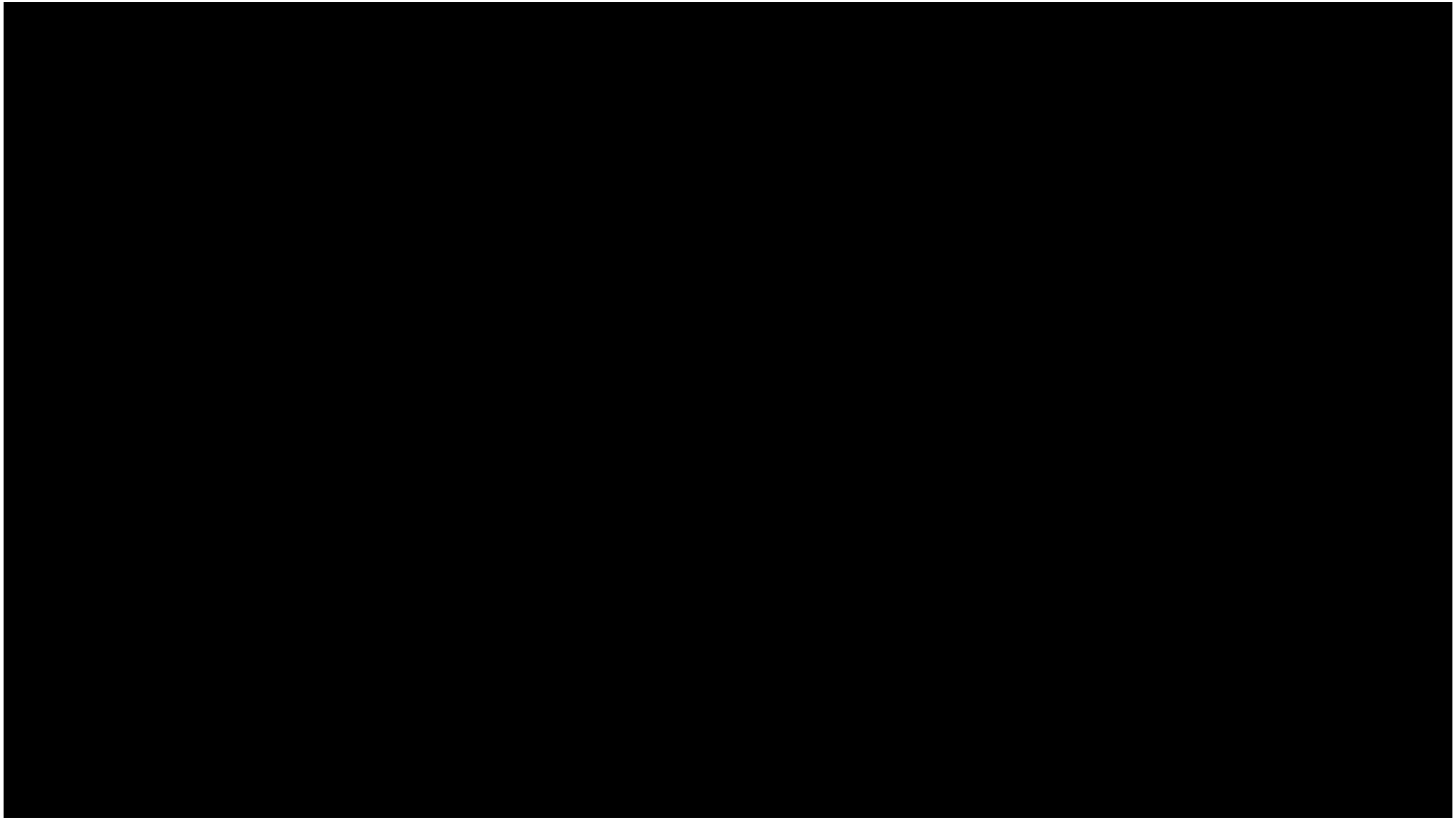
Long term **c**PDPH

Complex L4-L5 PDPH

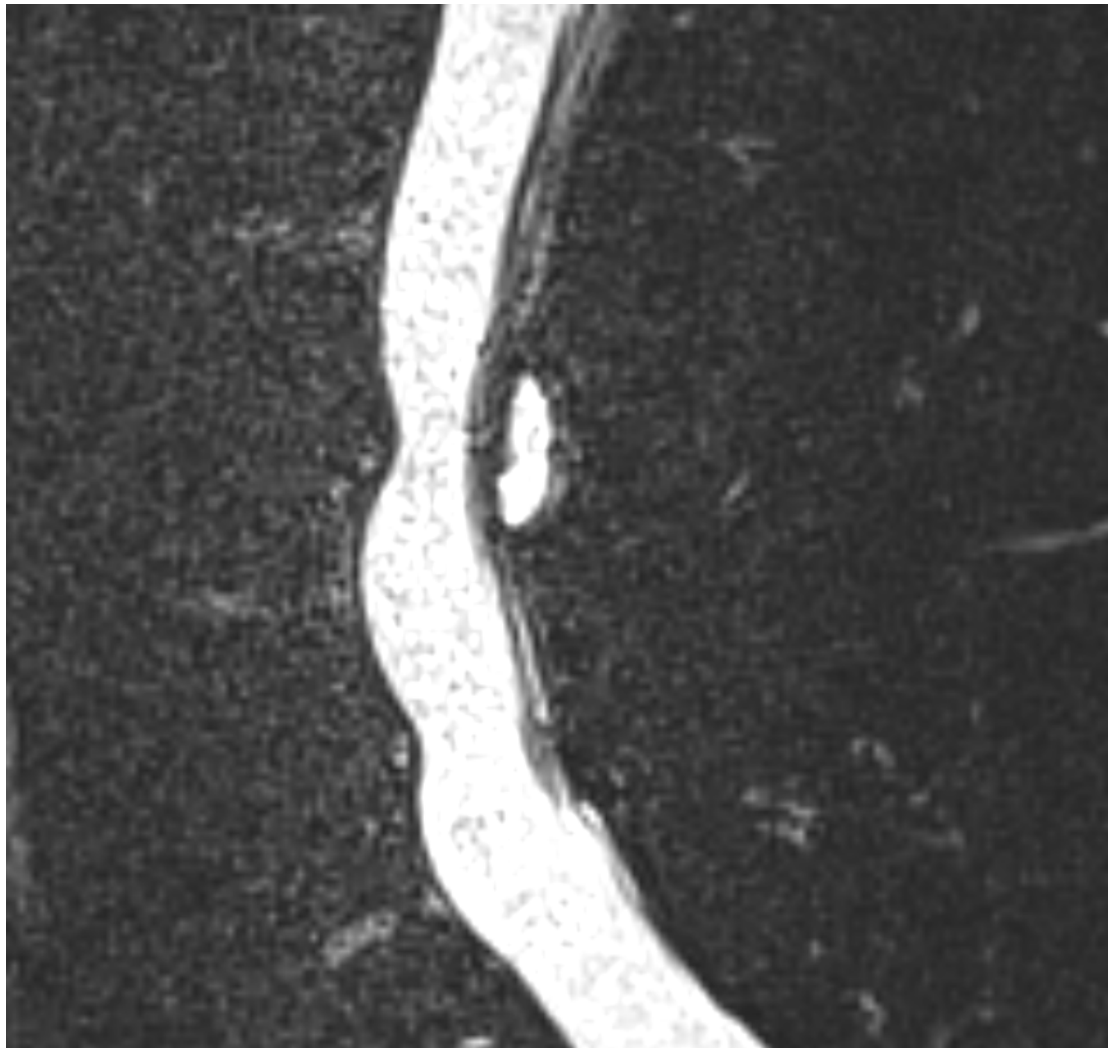




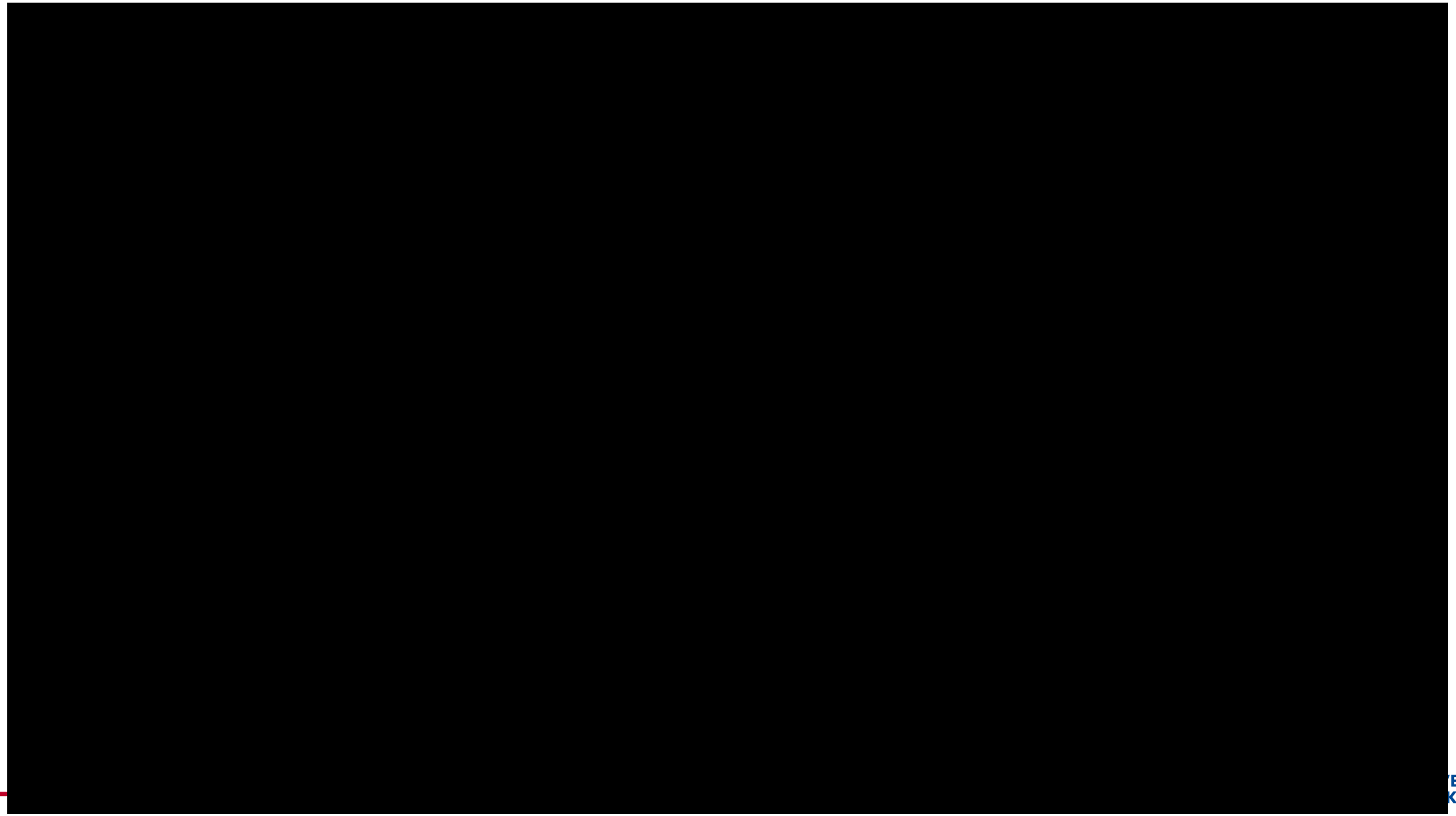
Chronic L4-L5 leak – extensive neo-membranes



Chronic PDPH (20 years) - strangulated fascicles



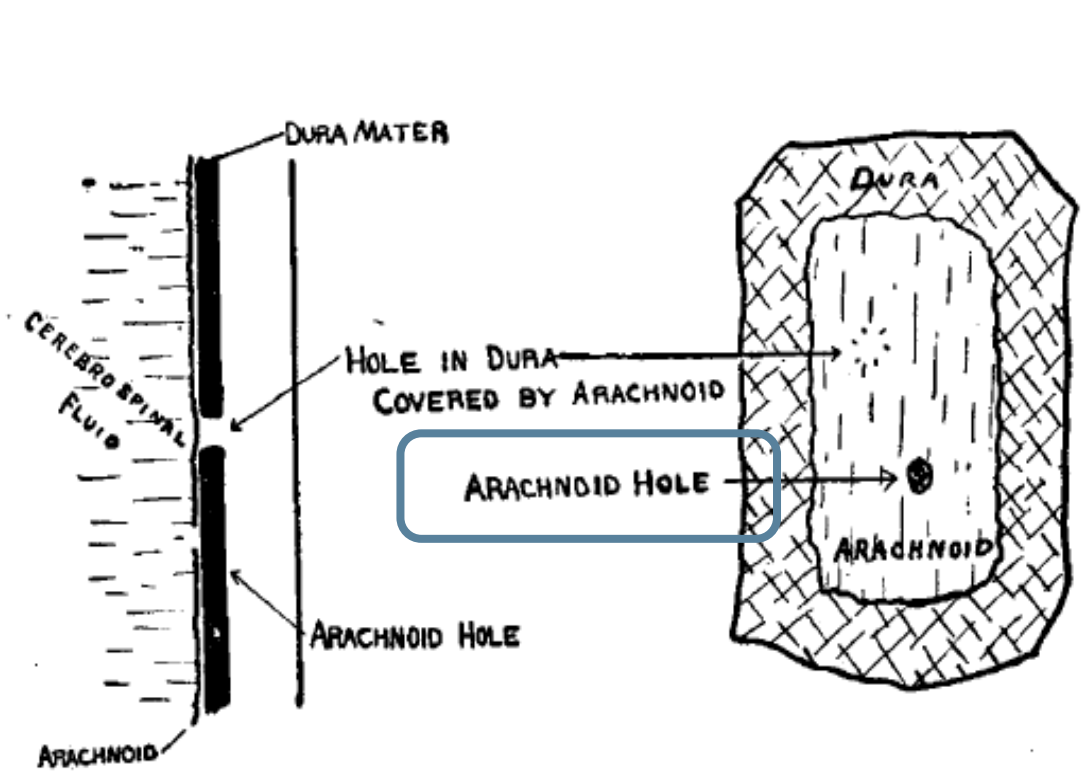
Chronic PDPH (20 years long) - strangulated fascicles

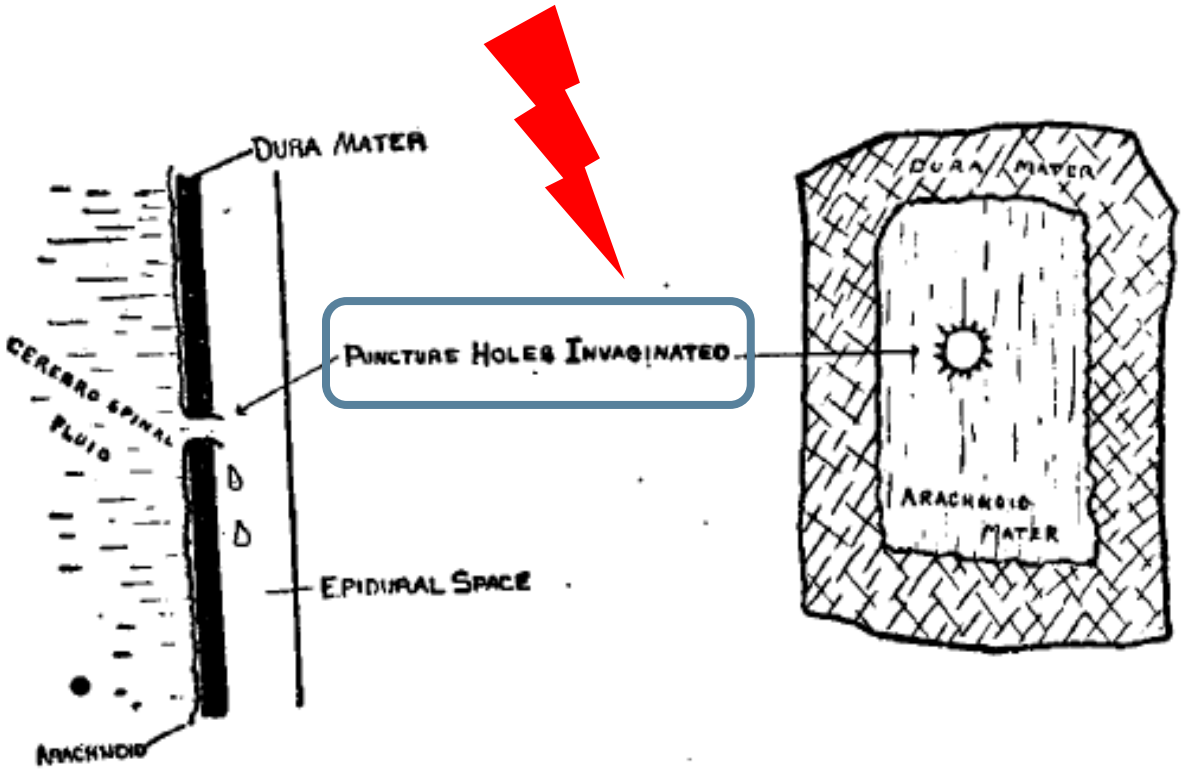


THE CAUSE OF LUMBAR PUNCTURE HEADACHE

RUSSELL G. MACROBERT, M.B. (TOR.)
Associate Physician, Neurological Institute
NEW YORK

JOUR. A. M. A.
MAY 11, 1918





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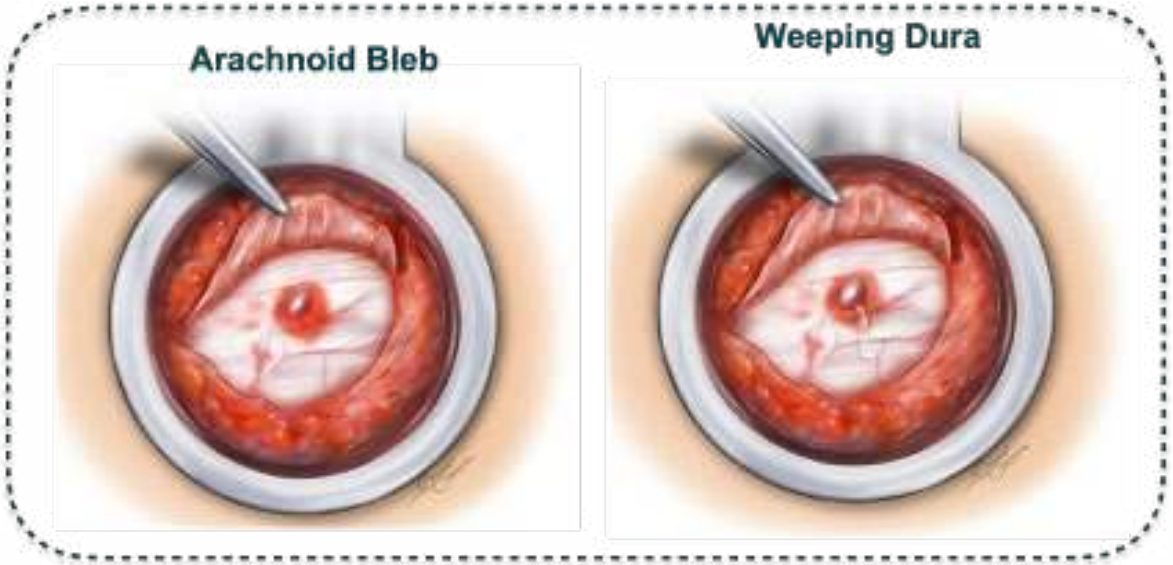
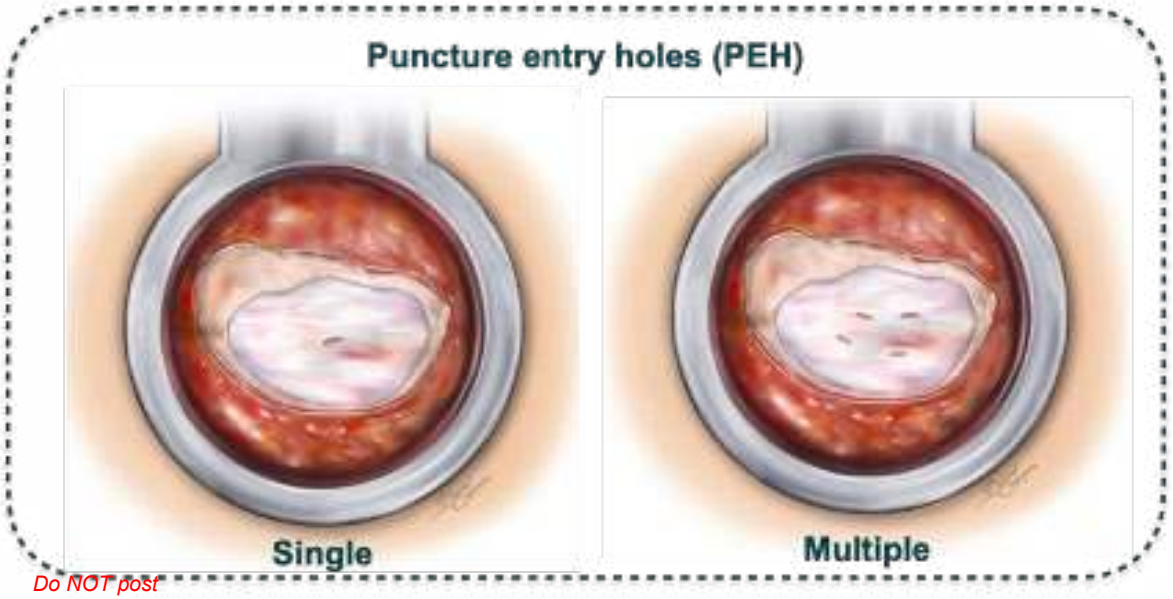
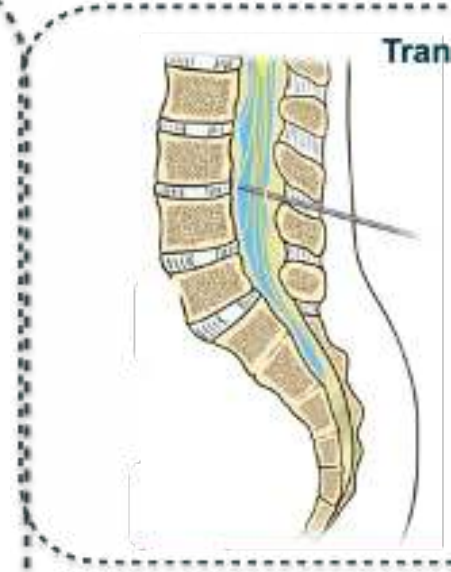
PDPH - Surgical anatomy and findings



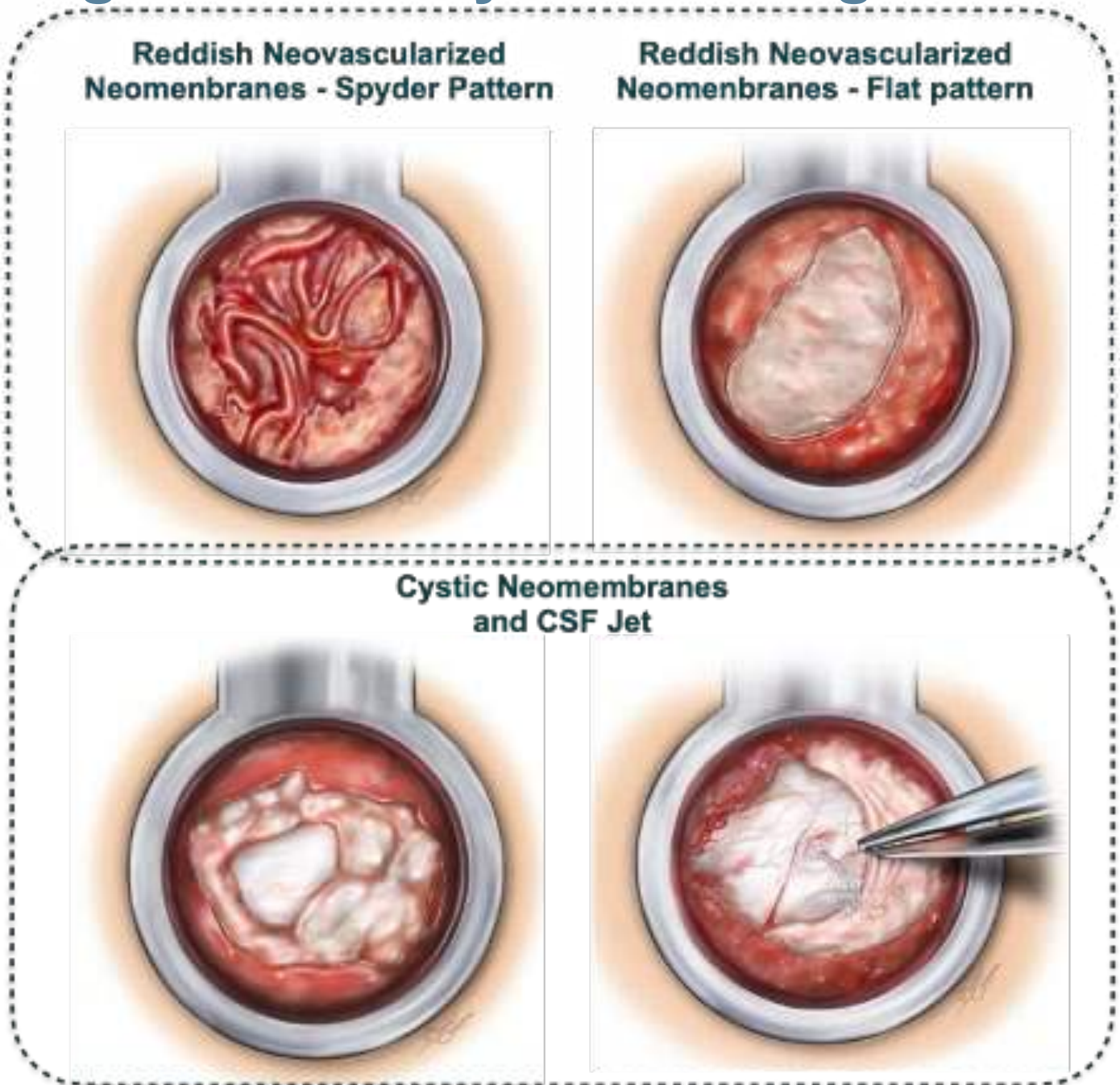




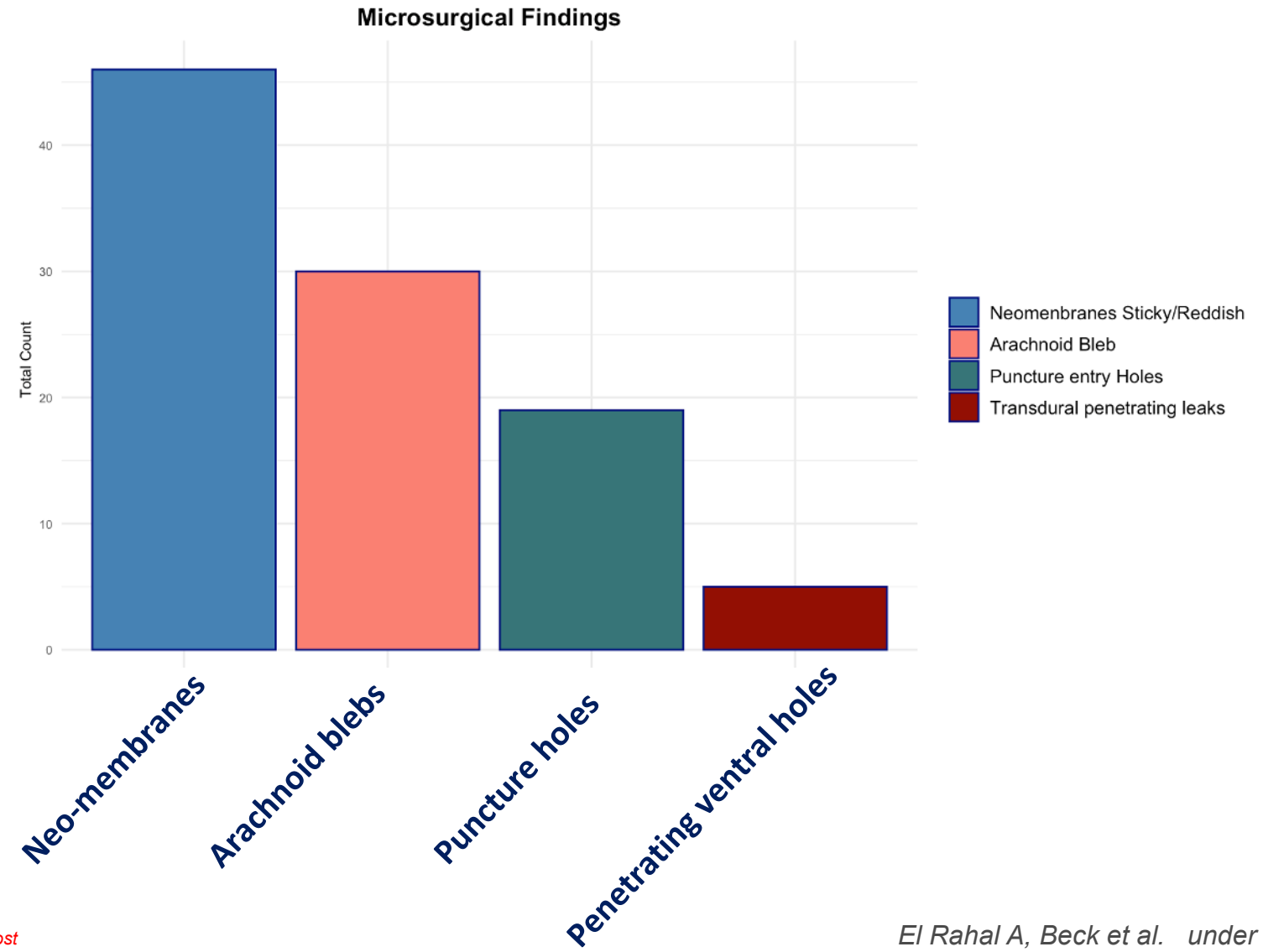
El Rahal A, Beck et al. under review 2025

PDPH - Surgical anatomy and findings

PDPH - Surgical anatomy and findings



PDPH - Surgical anatomy and findings



El Rahal A, Beck et al. under revision

CSF hypotension state ?

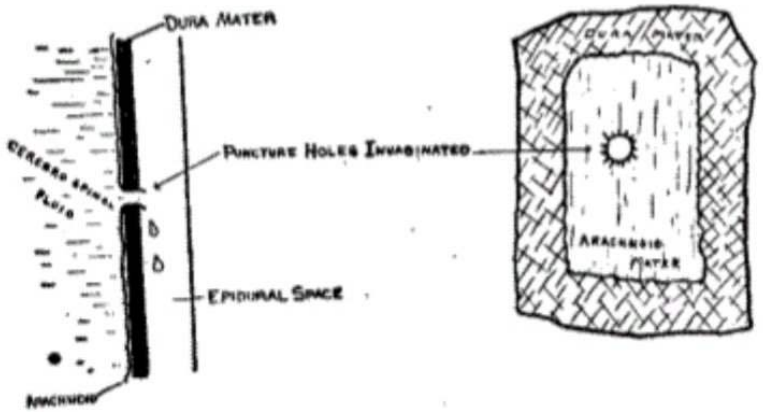


TABLE IV

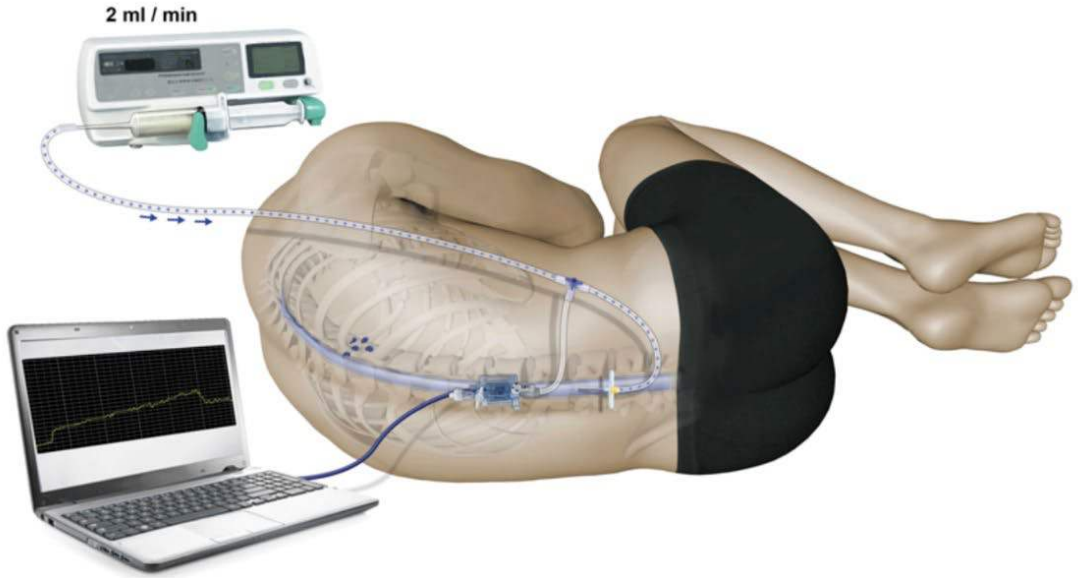
SUMMARY OF DIFFERENCE BETWEEN CEREBROSPINAL FLUID PRESSURE AT FIRST AND SECOND LUMBAR PUNCTURE IN RELATION TO HEADACHE

Headache	Pressure Decreased	Pressure Unchanged or Increased	Total
Present ..	4	1	5
Absent ..	20	17	37
Total ..	24	18	42

Smith et al 2019: „Risk of PDPH does not appear to be influenced by ***opening pressure****, CSF pressure, volume or* ***pressure-volume-index****"*

Marshall J. Lumbar-puncture headache. J Neurol Neurosurg Psychiatry. 1950; 13: 71-74

Diagnostics ? CSF dynamics?



R_{CSF} out is not related to cPDPH

cPDPH – pathophysiology ?

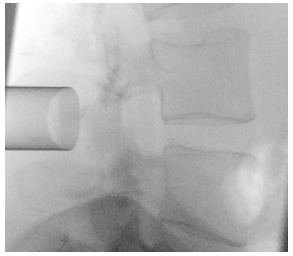
leaking – oozing/weeping – absorbtion

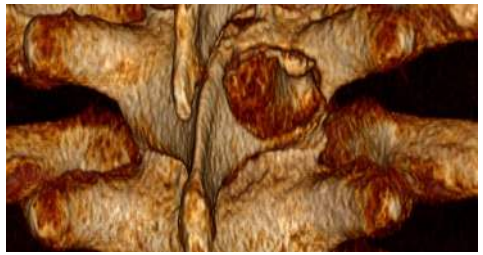
metabolic syndrom

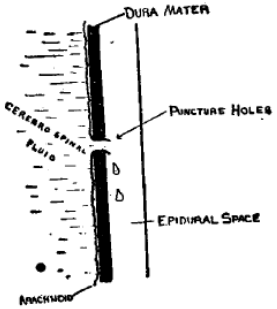
by membranes ?

cPDPH Program – Surgery for PDPH – Freiburg CSF-Center

1. **Resect pathology** – neo membranes and pathological vessels
2. **Restore anatomy** – rebuild layers and augment dura
3. **Respect arachnoid** – key element to prevent CSF leaking / oozing







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cPDPH Program – Freiburg CSF-Center

IMAGING

MRI:
- Whole brain
- Heavily T2 spine MRI
- Dinosaur sign
- Arachnoidal blep
- Epidural fluid
- Cine motion MRI

Optional
- Dynamic myelogram
- Dynamic CT-myelo

CLINCAL SPECTRUM

The Freiburg SIH/pPDPH Inventory

Neuro-psychological evaluation

PROMs

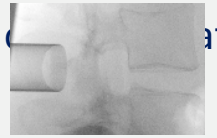
Smart watch health profile

TARGETED TREATMENT

Epidural blood patches

Multi-disciplinary Team
CSF-Board decision

Multilevel - MIS minimal invasive surgi ation



SUPPORTIVE TREATMENT

Interdisciplinary multimodal pain treatment

PROMS
Outpatient visists

LONG-TERM FOLLOW-UP & OUTCOME EVALUATION

UNIVERSITÄTS KLINIKUM FREIBURG

CSF-Center Freiburg

EANS CerebroSpinal Fluid Section

International Collaborations

Inselspital Bern, Switzerland

Lindenhofspital Bern, Switzerland

UZH Zuerich, Switzerland

AKH, Vienna, Austria

University College London, UK

King's College, UK

Danish Headache Center, Denmark

Cedars Sinai, CA, USA

Stanford, CA. USA

Nagoya University, Japan

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L. Krismer, M. Overstijns, M. Shah

Neuroradiology
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C. Zander, T. Demerath

Nuclear Medicine
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Anesthesiology
H. Bürkle & Team

Neuroophthalmology
W. Lagrèze & Team

Neuromedical AI Lab
T. Ball & Team

Medical Physics
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Thank you

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PDPH - Surgical anatomy and findings