

Post-Dural Puncture Headache(PDPH): an update

Dorel Sandesc

August Bier 1898: a personal experience of post dural puncture headache

“Toward the evening I was forced to take to bed and remained there for nine days, because all the manifestations recurred as soon as I got up. At midnight a violent headache set in that quickly became insupportable.”



Dural puncture

- Diagnostic lumbar puncture
 - To measure CSF pressure
 - Withdraw CSF for laboratory analysis
- Myelography (to instill radioopaque dye)
- Intrathecal chemotherapy
- **Spinal anesthesia**
- **Accidental Dural Puncture (ADP) during epidural insertion**

Postpartum headache within 6 weeks of delivery

985 women

38.7% reported postpartum headache

Tension type	38.4%
Migraine	37.4%
Musculoskeletal	12.3%
Undetermined	8.1%
<u>PDPH</u>	<u>4.5%</u>



Incidence of PDPH

-the role of the needle-

Needle Type & design	Gauge	Incidence
Tuohy (epidural)	16-18	45-80%
Quincke	20	16%
Quincke vs Pencil Point	22	10% vs 1.6%
Quincke vs Pencil Point	24	6% vs 1.5%
Quincke vs Pencil Point	25	6% vs 1.1%
Quincke vs Pencil Point	27	1.5% vs 0%
Pencil Point	29	<2%

Incidence of PDPH

-other factors-

- Patient related (age, gender etc)
- Technical factors
 - Use of **saline** instead of **air** for loss of resistance (LOR)
 - Orientation of epidural needle bevel
 - Needle tip deformation and dural perforation

Jokinen MJ, Pitkanen MT, Lehtonen E, Rosenberg PH. Acta Anaesthesiol Scand 1996; 40: 687–90

Incidence of Accidental Dural Puncture (ADP)

Darvish et al. Acta Anaesthesiol Scand 2011	1% (n≈900)
Baysinger et al. J Clin Anesth 2011	<2%
Gungor & Gunaydin Turk J Anesth 2008	1.2% (n=972)

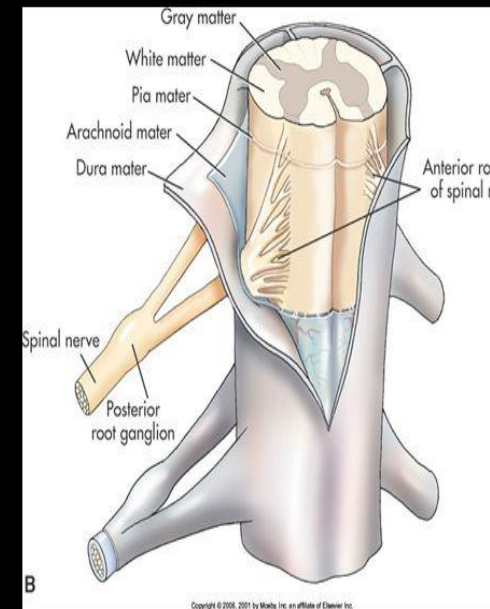


Anatomy of the spinal dura mater -classical-

- the spinal dura mater:
collagen fibres running in a
longitudinal direction

Spinal Cord

- Cylindrical, grayish white structure
- Meninges
 - Dura Mater
 - Outer strong, dense, fibrous sheet
 - Arachnoid Mater
 - Middle layer
 - Subarachnoid Space: Filled with cerebral spinal fluid.
 - Pia Mater
 - Inner vascular layer



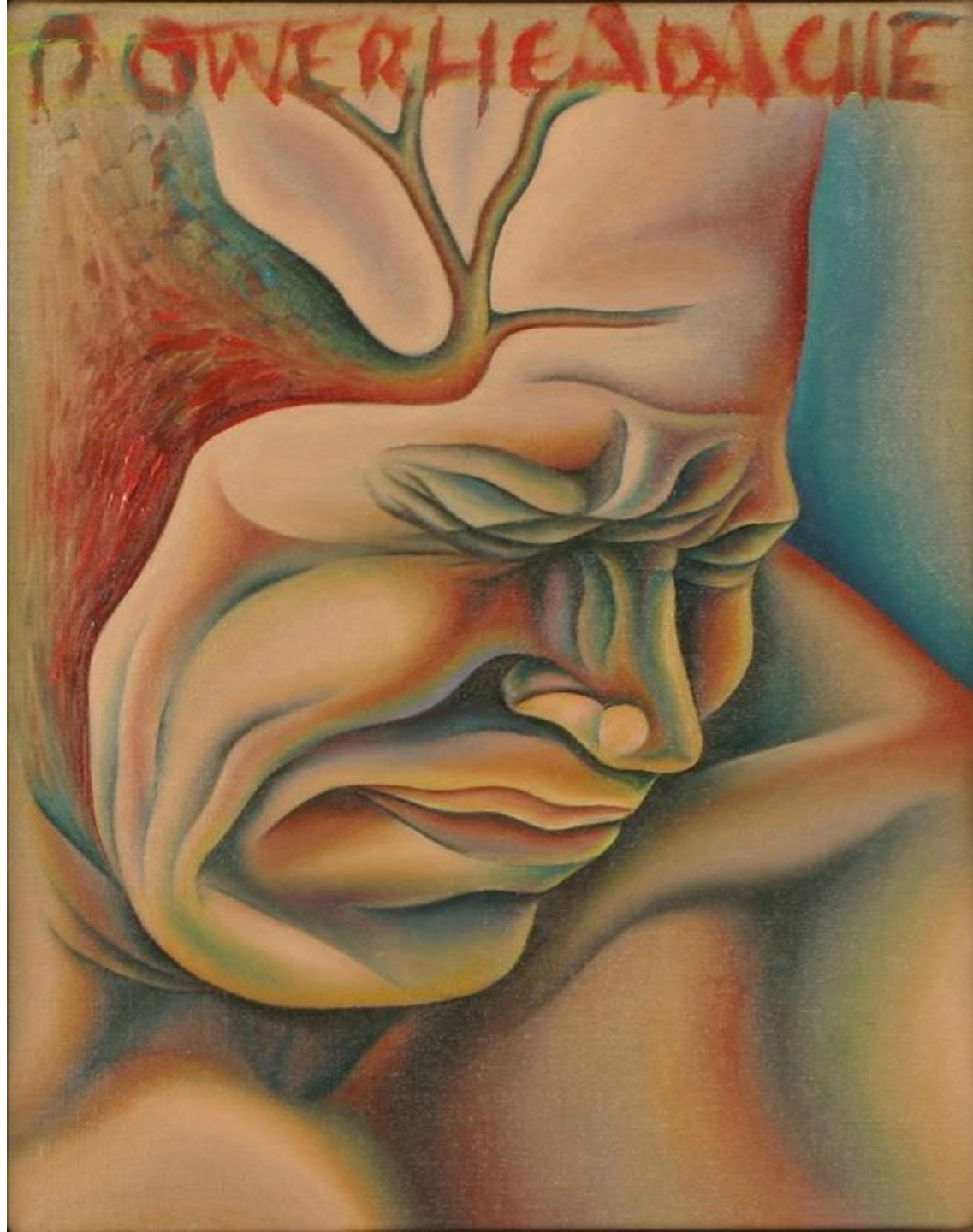
Anatomy of the spinal dura mater

-recent lightµscopic studies-

- collagen fibres arranged in **several layers** parallel to the surface that **do not demonstrate specific orientation**
- posterior dura **varies in thickness, not predictable** within an individual or between individuals
- *Reina MA, de Leon-Casasola OA, Lopez A, De Andres J, Martin S, Mora M. Reg Anesth Pain Med 2000; 25: 393–402*

Cerebrospinal fluid

- Total volume of CSF \cong **150 mL**
 - 50% in the cranium (75 ml supraspinal, 75 ml spinal)
-
- \cong 450-500 mL (**0.35 mL/min**) **CSF is produced daily**
 - **CSF pressure in the lumbar region is**
 - 5 to 15 cmH₂O in the supine position
 - it exceeds 40 cmH₂O in the upright position



**JUDY
GARLAND**

Dura mater and response to trauma

- In 1923: deliberate dural defects in the cranial dura of dogs took approximately one week to close
- 1959: the dural repair was facilitated by fibroblastic proliferation from surrounding tissue and blood clot and NOT fibroblastic proliferation from the cut edge of the dura(1).
- Gormley's original observation: bloody taps were less likely to lead to a post-dural puncture headache as a consequence of a persistence CSF leak(2).

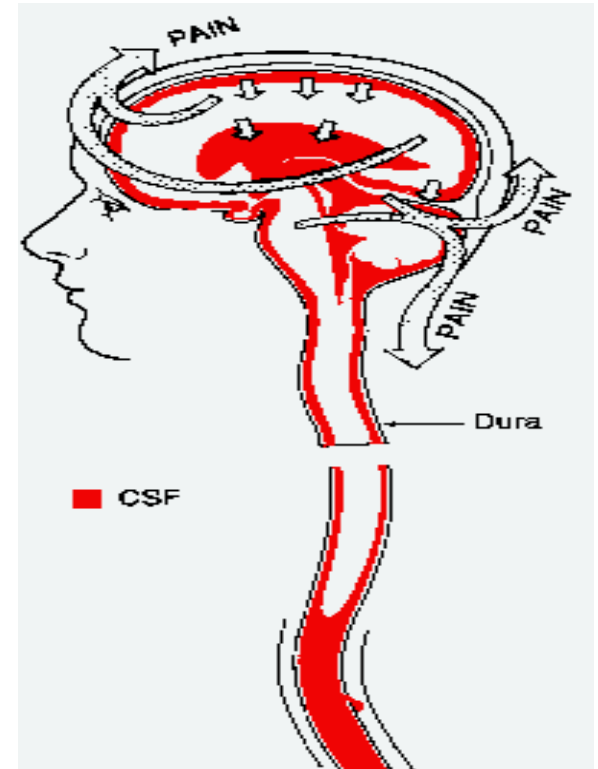
1. Keener EB. An experimental study of reactions of the dura mater to wounding and loss of substance. J Neurosurg 1959; 16: 424–47

2. Gormley JB. Treatment of post-spinal headache. Anesthesiology 1960; 21:565–6

PDPH: Pathophysiology

-intracranial hypotension-

- Persistent CSF loss through the hole
- Decrease in the CSF volume and/or pressure leading to shift of the intracranial contents and traction on the pain sensitive structures
- Loss of cushion effect



rate of CSF loss

rate of CSF production

$$0.084-4.5 \text{ ml/sec} > 0.0058 \text{ ml/sec} \\ (0.35 \text{ ml/min})$$

Ciara McQueirns
"No Really, It's Just A Headache"



PDPH: Pathophysiology -cerebral vasodilatation-

- The Monro–Kellie doctrine: the sum of volumes of the brain, CSF, and intracranial blood is constant
- Decrease in CSF volume: compensatory increase in blood volume(venodilatation) responsible for the headache

Table 1.—The International Classification of Headache Disorders Diagnostic Criteria for Post-Dural Puncture Headache⁵⁵

-
-
- (A) Headache that worsens within 15 minutes after sitting or standing and improves within 15 minutes after lying, with at least one of the following and fulfilling criteria C and D
- Neck stiffness
 - Tinnitus
 - Hypacusia
 - Photophobia
 - Nausea
- (B) Dural puncture has been performed
- (C) Headache develops within 5 days of dural puncture
- (D) Headache resolves either
1. Spontaneously within 1 week
 2. Within 48 hours after effective treatment of the spinal fluid leak (usually by epidural blood patch)
-

Differential Diagnosis

- Non-specific headache
- Migraine
- Caffeine withdrawal
- Meningitis
 - *chemical or infective*
- Headache due to sinusitis
- Drugs like *amphetamine, cocaine*
- Pneumocephalus
- Preeclampsia
- Pituitary apoplexy
- Cerebral vein thrombosis
- Subdural hematoma
- Intracranial tumour

Emilio Pettoruti's Futurist Headache



PREVENTION of PDPH



1. Needle tip & designs for preventing PDPH (2013)
2. ***Epidural or intrathecal catheter placement techniques for preventing PDPH (2010)***
3. Posture & fluids for preventing PDPH (2013)
4. Drug therapy for preventing PDPH (2013)
5. ***Epidural Blood patching for preventing PDPH (2013)***

1. Needle tip & designs for preventing PDPH

Use of

- atraumatic needles without age limits
- proper needle material
- finer gauge needles in predisposed patients



2. Preventive Catheters Strategies

Epidural catheter replacement and intrathecal catheter techniques for preventing post-dural puncture headache following an inadvertent dural puncture in labour (Protocol)

Newman MJ, Cyna AM, Middleton P

Intra
Thecal
Catheter



THE COCHRANE
COLLABORATION®

Resiting
epidural
catheter

This is a reprint of a Cochrane protocol, prepared and maintained by The Cochrane Collaboration and published in *The Cochrane Library* 2010, Issue 1

<http://www.thecochranelibrary.com>

Does intrathecal catheter placement after wet tap reduce risk of headache?

115 consecutive unintentional dural punctures

	% PDPH	Blood Patch
A- epidural catheter @ a different space	91.9	81.1
B- intrathecal catheter removed @ delivery	51.4	31.4
<i>C- intrathecal catheter left in situ for 24 h</i>	6.2	3.1

Overall incidence: PDPH 46.9% - blood patch 36.5%

Hieronymus Bosch





ELSEVIER

www.obstetanesthesia.com

REVIEW ARTICLE

Insertion of an intrathecal catheter following accidental dural puncture: a meta-analysis

M. Heesen,^a S. Klöhr,^a R. Rossaint,^b M. Walters,^c S. Straube,^d M. van de Velde^c

47 studies initially included

10 - Editorials/reviews/surveys

10 - Case Reports

6 - Non obstetric patients

21 studies

7 - IT catheters not for accidental dural punctures

6 - no control group

8 studies analyzed

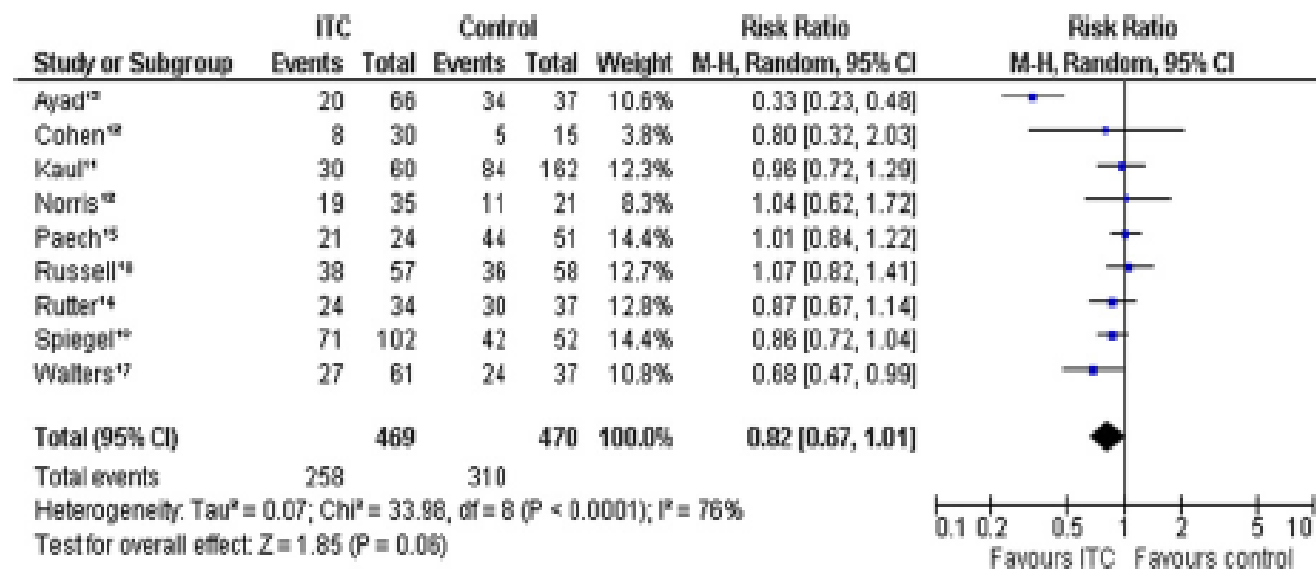


Fig. 2 Intrathecal catheterization and the incidence of postdural puncture headache.

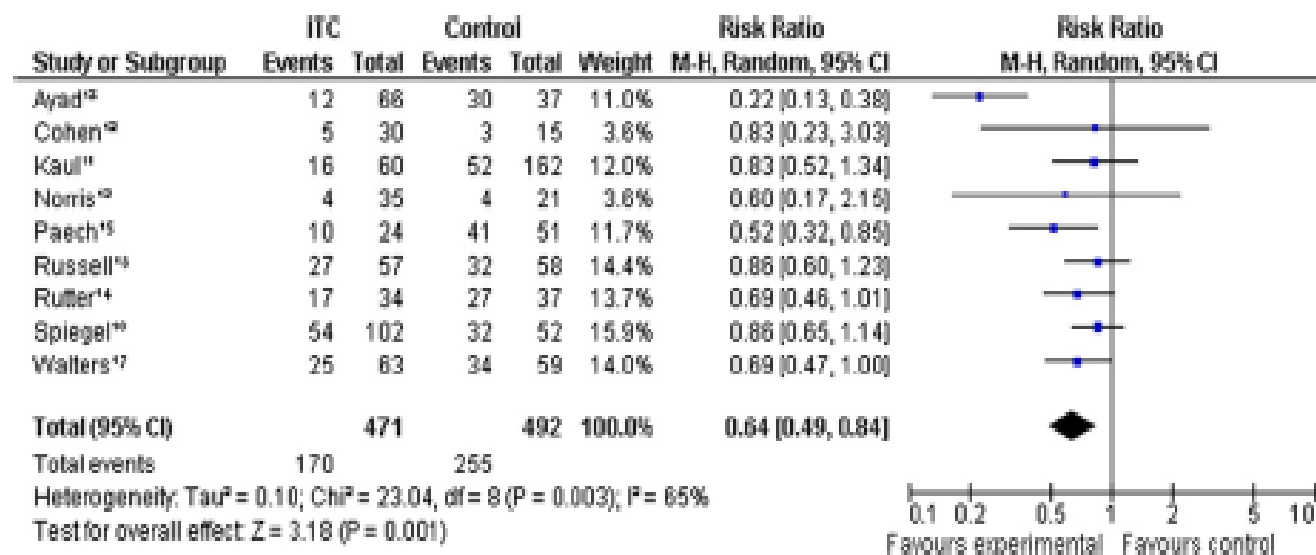


Fig. 3 Intrathecal catheterization and the need for epidural blood patch.

Vestraete et al. Acta Anaesthesiol Scand 2014

n=29749 regional blocks n=128 witnessed ADP (0.43%)	PDPH
Resited epidural catheter (n=39)	62%
ITC (n=89)	42%
Odds Ratio = 2.3 (95% Confidence Interval 1.04-4.86, p=0.04)	



Intrathecal Catheters: risk of infection ?

- However, it appears that limited periods of use (96 h or less) is not associated with either frequent local or spinal infections(1)
- Serious complications are rare in both hospitalized and homebound patients with intrathecal catheters(2)

1. Bevacqua BK, Slucky AV, Cleary WF. *Anesthesiology*. 1994 Jun;80(6):1234-40.

2. April D, Bandschapp O, Rochlitz C, Urwyler A, Ruppen W. *Anesthesiology*. 2009 Dec;111(6):1346-55.



3. Preventive bed rest and fluids

23 trials, n=2477	Bed rest (%)	Early mobilization (%)
Incidence of PDPH	26.4	20.5
Severe PDPH	10.6	10.7
Any headache after lumbar puncture	33.6	28.6

Authors' conclusions

- **No evidence** for routine bed rest after ADP *is beneficial* for the prevention of PDPH onset
- Role of fluid supplementation in the prevention of PDPH still remains *unclear*

Jean Spietzer.
Reclining Man With Headache



4. Drugs, preventive

Drug therapy for preventing post-dural puncture headache (Review)

Basurto Ona X, Uriona Tuma SM, Martínez García L, Solà I, Bonfill Cosp X



This is a reprint of a Cochrane review, prepared and maintained by The Cochrane Collaboration and published in *The Cochrane Library*
2013, Issue 2

<http://www.thecochranelibrary.com>

Coffeine

- Crosses blood brain barrier
- Central nerve system (CNS) stimulant
- Cerebral vasoconstrictor
- 300-500 mg oral/iv once/twice daily
(*one coffee: 50-100 mg; 330 ml Coca-Cola: 50 mg*)
 - after 4hs, decrease the severity of symptoms
 - **after 24 hs, no difference in severity of symptoms**
 - **no reduction in the EBP need**

Theophylline

- Methylxantine derivative
- Oral preps are long-acting
- Cerebral vasoconstrictor
- Cardiac problems restrict its use (CNS stimulation)
- Increase CSF production by stimulating the Na-K pumps

Sumatriptan

- 5HT_{1D} receptor agonist
- Cerebral vasoconstrictor
- Advocated for migraine
- Expensive
- SC injection (6 mg)
- $t_{1/2} = 2 \text{ h}$
- ineffective



Honore Daumier

5. Prophylactic Epidural Blood Patch

64 parturients with accidental dural puncture
Prophylactic EBP or Therapeutic EBP

	PEBP (n=32)	TEBP (n=32)
Onset of PDPH (d)	2.0	1.5
Maximum VAPS (0-10)	7	6
Recommended therapeutic EBP (n)	11	15
Therapeutic EBP performed (n)	9	14
> 1 Therapeutic EPB (n)	2	1

No. days with PDPH was less in Prophylactic EPD group

Original Article

Prophylactic vs therapeutic blood patch for obstetric patients with accidental dural puncture – a randomised controlled trial

M. H. Stein,¹ S. Cohen,² M. A. Mohiuddin,³ V. Dombrovskiy⁴ and I. Lowenwirt⁵

109 women RCT

Prophylactic blood patch vs conservative management

Intervention: 15-20 ml of blood via catheter 5 hours after LA

Group P, n=60; Group C, n=49

Results: PDPH: 18.3% (P) vs 79.6% (C) $p < 0.0001$

Blood patch in C group: 73.4%

2nd blood patch: 10% (P) vs 11.1% (C)

Migraine Painting by Tim Nyberg



THERAPY

1. Medical Therapy

2. Invasive Therapy

Goals

- Control the vasodilation with cerebral vasoconstrictor drugs
- Replace the lost CSF fluid
- Seal the puncture site

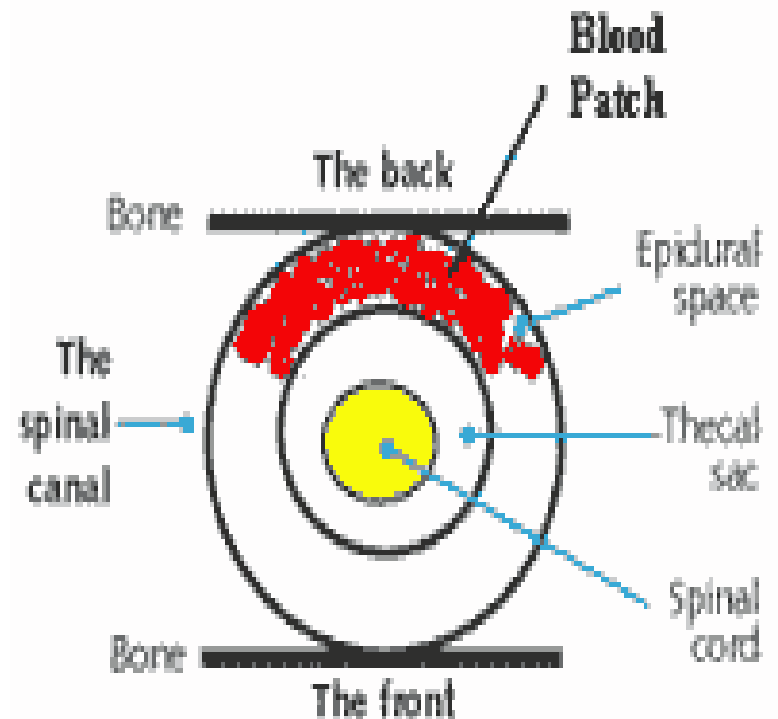
Drugs

- **Gabapentin** 300-400 mg (GABA analog)
 - **Pregabalin** 50 mg (every 8 h for 3 days)
- **Frovatriptan** 2.5 mg oral once for 5 days
- **Caffeine and theophylline**
- **ACTH**
 - increase CSF production via Na active transport mechanism or raise beta endorphine levels
 - 60 units IM or 1.5 unit/kg iv over 1 hour
- **Hydrocortisone** iv 200 mg



Epidural Bloof Patch(EBP)

- History (*Gormley 1960, DiGiovanni & Dunbar 1970*)
- Plug theory
- Pressure patch hypothesis



EBP

Contraindications of EBP

- Infection on the back
- Sepsis
- Coagulopathy
- Raised white cell count
- Prexia
- Patient refusal

Indication

- Severe and/or failed conservative treatment

Timing

- Beyond 24 h after ADP

Recumbent positioning

- For 2 h after patching may improve the efficacy

Effectiveness of EBP

Prospective observational study, 1988-2000, 504 pts:

- success: 93% (75% complete, 18% incomplete)
- failure: 7%
- success post 2nd blood patch: 97%



The Scream
Edvard Munch

Săndesc D. Monica Lupei. C. Plavat. Conventional treatment or epidural blood patch for the treatment of different etiologies of postdural puncture headache .

Acta Anaesthesiol Belg 2005, 56(3) : 265-269

- EBP is a gold standard therapy of PDPH, significantly superior to conventional medical treatment no matter the etiology
- There is no reason to delay the EBP for more than 24 hours
- In our opinion the technique has to be performed at the level of the causative dural puncture or with one space lower

Săndesc D, Nediglea I et al. Cefaleea postpunctie durală: tratament medicamentos versus “blood patch” peridural. Jurnalul Român de Anestezie Terapie Intensivă 2002, 9(2):101-105

Epidural Fibrin glue (fibrin+thrombin)

- Placed blindly or CT guided
- Risks:
 - infections
 - immune reactions
 - anaphylaxis
 - spinal cord or nerve root compression via mass effect



Crul et al. Anesthesiology 1999

Sachs & Smiley. Sem Perinatol 2014

Neurosurgical Treatment

Brief Report

Cephalalgia
An International Journal of Headache



International
Headache Society

Successful treatment of post-dural-puncture headache with surgical dura repair two years after spinal anesthesia

Cephalalgia

33(15) 1269–1271

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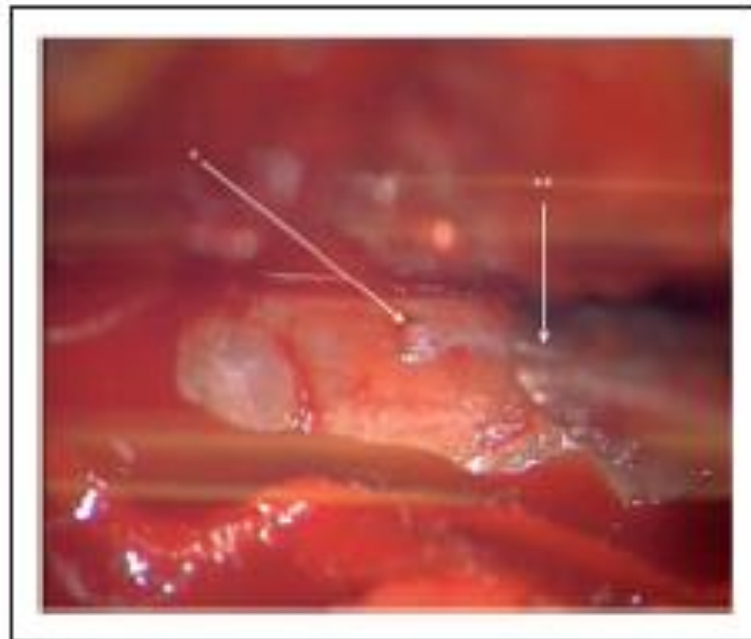


Figure 2. View of the operative field under the microscope



*Sărbători
Fericite!*

The image is a festive holiday-themed graphic. It has a solid red background. On the left side, there are faint, large, white snowflake patterns. On the right side, there is a large, dense cluster of white stars and snowflakes of various sizes, creating a sparkling effect. The text 'Sărbători Fericite!' is written in a white, elegant, cursive script font, positioned in the center-left area of the image. The overall composition is balanced and celebratory.