



The Anesthesiologists' View of Post Dural Puncture Headache: prevention and treatment

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No disclosures

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Basic Principles: Anesthesiology



We cure/prevent pain



Causing pain is a source of great stress for all involved



We are interventionalists by nature



Although we are dedicated to the scientific method, many of our interventions are empiric

Basic Principles: Obstetric Anesthesiology

- Neuraxial Analgesia far surpasses any other labor pain management modality
- Neuraxial Anesthesia is typically the best option for cesarean delivery anesthesia, yet:



- ~1% patients get a PDPH
- Some of have chronic sequela



Diagnosing PDPH



Definition:

Headache attributed to low cerebrospinal fluid (CSF) pressure occurring within 5 days of a lumbar puncture (LP), caused by CSF leakage through the dural puncture.

Clinical Features:



- Typically, postural*
- Usually associated with neck stiffness
- +/- subjective hearing symptoms

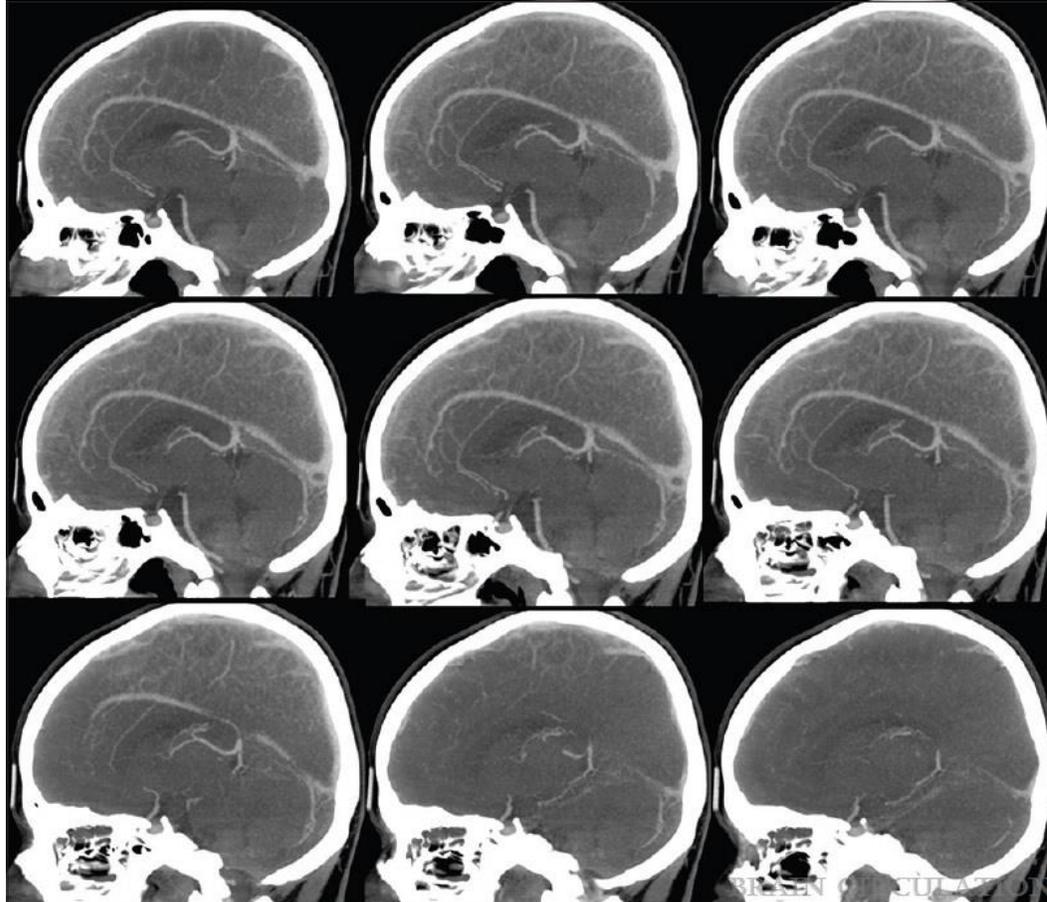
*usually but not invariably orthostatic

Source: International Classification of Headache Disorders (ICDH-3)

Is imaging required in PDPH?

Red Flag Symptoms:

- a change in severity or nature of headache
- altered level of consciousness
- seizures or
- focal neurological signs



[Cerebral venous sinus thrombosis in pregnancy and puerperium: A comprehensive review](#)

Algahtani, Hussein; Bazaid, Abdulrahman; Shirah, Bader; Bouges, Raghad N

Brain Circulation8(4):180-187, Oct-Dec 2022.

doi: 10.4103/bc.bc_50_22

CT venography showing CVST involving more than the anterior two-thirds of the superior sagittal sinus extending into the bilateral superior frontal cortical veins. CT: Computed tomography, CVST: Cerebral venous sinus thrombosis

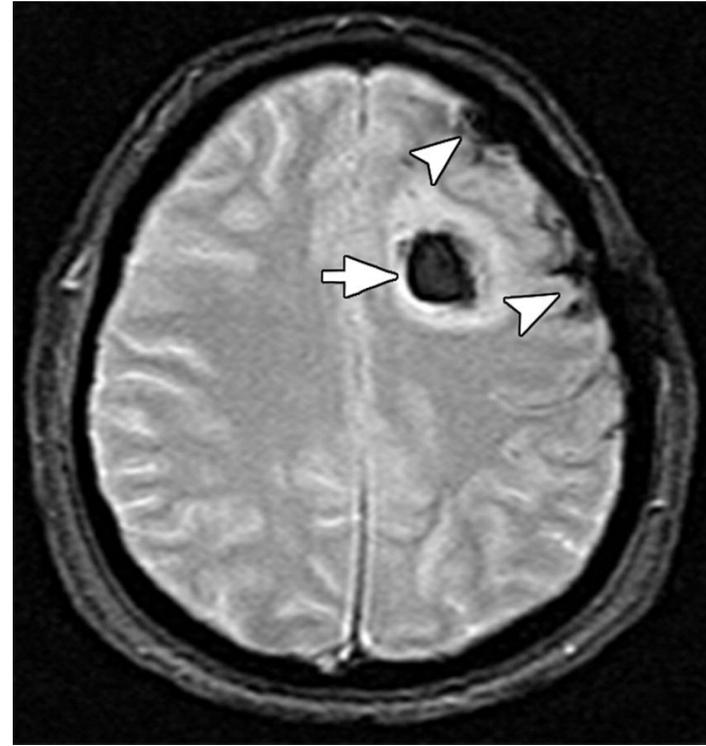


Figure 1a. Intracranial bleeding in a 31-year-old woman who was 32 weeks pregnant and experiencing eclampsia and seizure. **(a)** Axial nonenhanced head CT image shows acute intraparenchymal bleeding (arrow) with surrounding edema in the left frontal lobe. **(b)** Axial gradient-echo MR image shows a left frontal lobe hemorrhage (arrow) and left frontal SAHsubarachnoid hemorrhage (arrowheads).



Postpartum headache – diagnosis and treatment

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[#postpartum-headache-postpartum-headache-postpartum-headache](#)

Table 1 Differential diagnoses of postpartum headache.

Primary
Migraine
Tension headache
Secondary
Cranial vascular disorders
Subarachnoid haemorrhage
Subdural haematoma
Intracerebral haemorrhage
Cerebral venous sinus thrombosis (CVST)
Cerebral ischaemia
Arterial dissection
Posterior reversible encephalopathy syndrome (PRES)
Reversible cerebral vasoconstrictive syndrome (RCVS)
Pituitary apoplexy
Non-vascular cranial disorders
Benign intracranial hypertension
Spontaneous intracranial hypotension
Postdural puncture
Space occupying lesions
Pneumocephalus
Infection
Sepsis
Meningitis
Sinusitis
Disorders of homeostasis
Hypertensive disorders of pregnancy
Others
Drug-related
Caffeine withdrawal



Pathophysiology of PDPH

- Traction on pain-sensitive structures such as meninges, arteries near the base of brain, and anchoring veins if “brain sagging”
- Cerebral vasodilation, either reflex response to traction or compensatory mechanism due to decreased CSF volume
- Activation of the trigeminovascular system (TVS)

Original research

Brain MRI features of postdural puncture headache

Fernando J Sánchez García , Jose Jornet Fayos, Aida Pastor del Campo, Jose Emilio Llopis Calatayud

RAPM, 2023

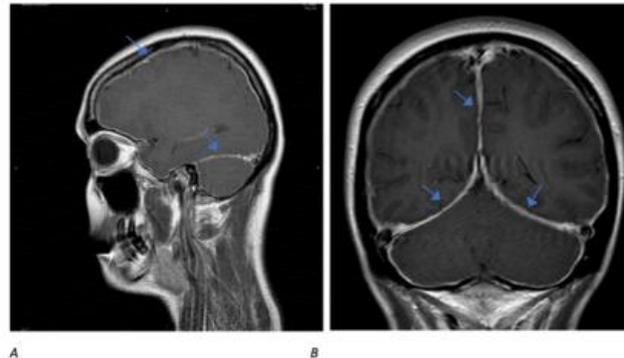


Figure 1 Brain MRI: Pachymeningeal enhancement (arrows). (A) Sagittal gadolinium-enhanced TSE, T1-weighted brain MRI. (B) Coronal gadolinium-enhanced TSE, T1-weighted brain MRI.

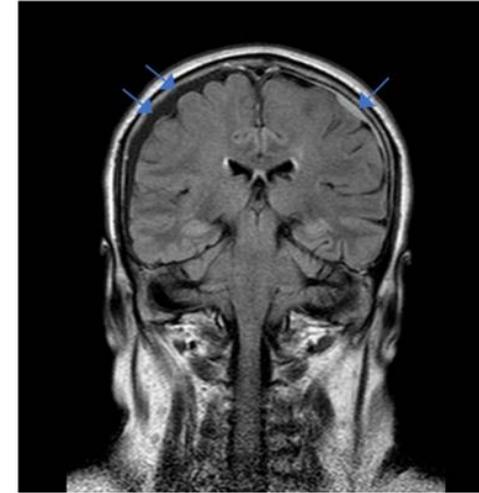


Figure 2 Coronal FLAIR T1-weighted brain MRI. Acute hygroma (arrow) and hygroma (pair of arrows).

- Brain MRI 48-72 hours after PDPH onset
- No evidence of brain sagging

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HEADACHE
SOCIETY



Original research

Evidence-based clinical practice guidelines on postdural puncture headache: a consensus report from a multisociety international working group

Vishal Uppal ¹, Robin Russell ², Rakesh V Sondekoppam ³,
Jessica Ansari ⁴, Zafeer Baber⁵, Yian Chen ⁶, Kathryn DelPizzo ⁷,
Dan Sebastian Dirzu ⁸, Hari Kalagara ⁹, Narayan R Kissoon ¹⁰,
Peter G Kranz ¹¹, Lisa Leffert ¹², Grace Lim ^{13,14}, Clara Lobo ¹⁵,
Dominique Nuala Lucas ¹⁶, Eleni Moka ¹⁷, Stephen E Rodriguez ¹⁸,
Herman Sehmbi ¹⁹, Manuel C Vallejo ²⁰, Thomas Volk ²¹,
Samer Narouze ^{22,23}



Methods



Expert Taskforce Convened



Relevant Literature Search and Systematic Review- subset questions



Modified Delphi Process-USPSTF Grading of Evidence



Draft Consensus Statement



Peer Review

Patient Factors Associated with PDPH

- PDPH incidence varies widely following spinal anesthesia from <2% to 40%, depending on needle gauge.
 - In the obstetric population, the risk of dural puncture with epidural insertion is around 1.5%, with ~half developing PDPH.

Studies Evaluating Patient Factors:

- Study 1 Ages 12-19 vs 20-45 [aOR **2.8** 95%CI (1.1-7.3)]
- Study 2: ages 16-30 vs > 30 [OR **2.1** 95% CI (1.1-2.2)]
- Body mass index

Comorbidities

- History of headache → increases risk (moderate)
- Smoking → decreases risk (low)
- Depression



Modifiable Risk Factors for PDPH

Needle Characteristics:

- Impact is a result of the interaction between size, type, and # of redirections
- 8/10 studies comparing cutting needles of different sizes found reduction in risk with narrower needle
 - Less difference with non-cutting needles.

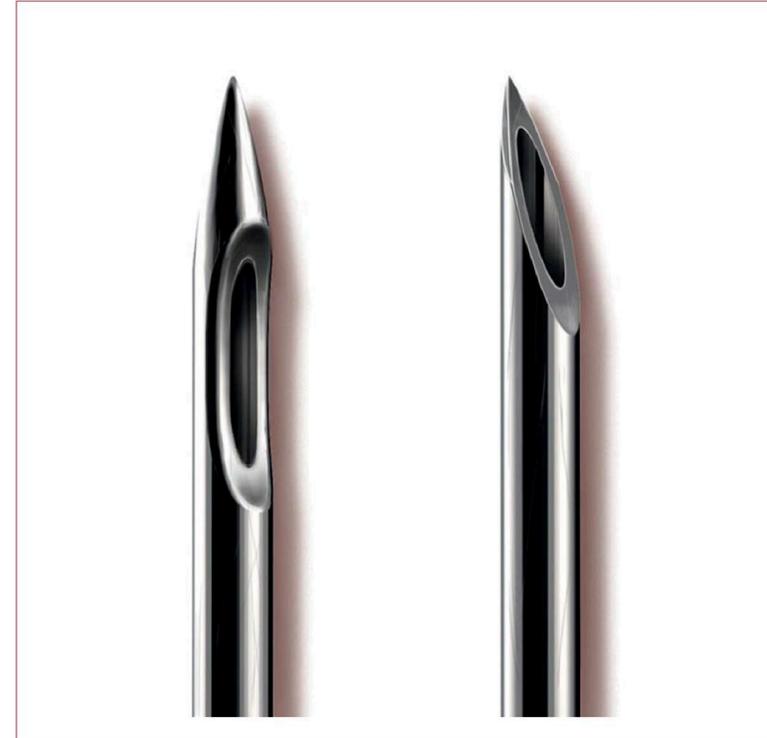


Figure 1: Atraumatic and conventional needle tip designs
A schematic of magnified atraumatic (left) and conventional (right) lumbar puncture needle tips.

Comparison of Dural Lesions from Spinal Needles

25-G Quincke

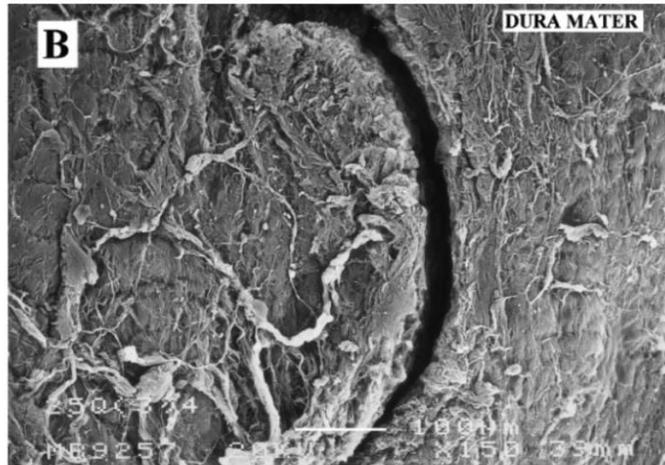


Fig 1. Dural lesions produced by 25-gauge Quincke needles. Dural surface observed from the epidural space. Puncture made with the bevel in perpendicular (A) and parallel (B) direction in relation to the axis of the spinal cord. Both lesions have equal morphology. Scanning electron microscopy (SEM). Original magnification $\times 200$; bar, 100 μm .

25-G Whitacre

8 Regional Anesthesia and Pain Medicine Vol. 25 No. 4 July–August 2000

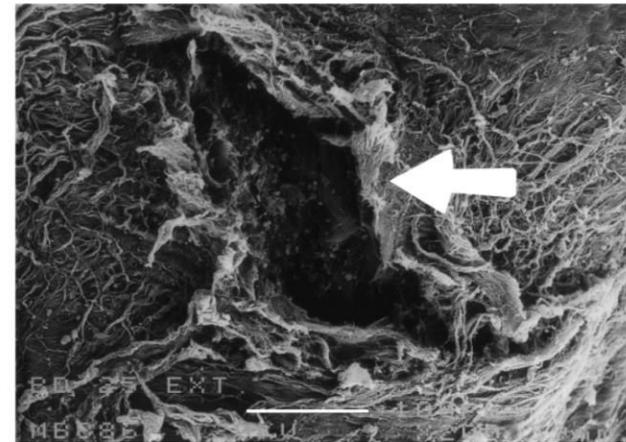


Fig 3. Dural lesion produced with a 25-gauge Whitacre needle seen from the external (epidural) surface. Note the "flaps" collagen fibers at the borders of the lesions. SEM. Original magnification $\times 200$; bar, 100 μm .

Atraumatic versus conventional lumbar puncture needles: a systematic review and meta-analysis

Siddharth Nath, BSc • Alex Koziarz, BSc • Jetan H Badhiwala, MD • Waleed Alhazzani, MD • Prof Roman Jaeschke, MD • Sunjay Sharma, MD • et al. Show all authors

Published: December 06, 2017 • DOI: [https://doi.org/10.1016/S0140-6736\(17\)32451-0](https://doi.org/10.1016/S0140-6736(17)32451-0) • Check for updates

- Risk of PDPH 60% lower with atraumatic needle
- NNT=5

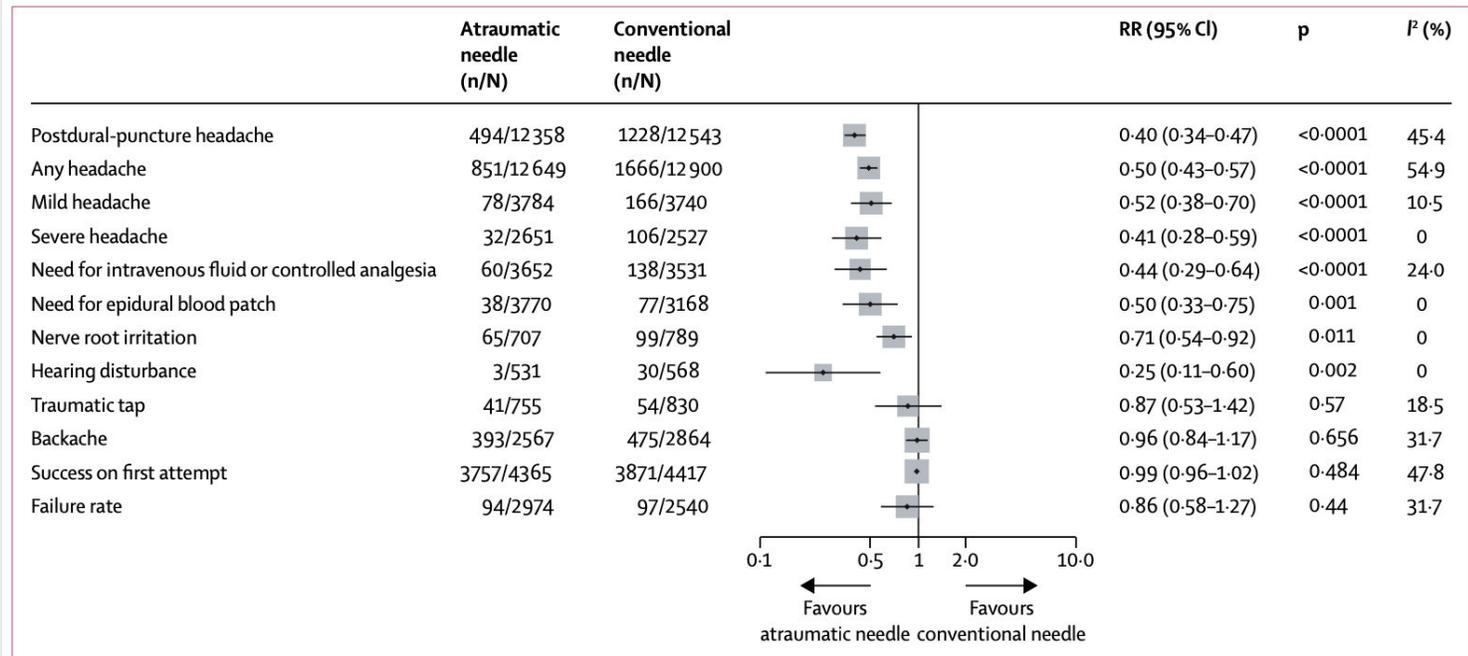


Figure 3: Pooled analysis of relative risk according to outcome

If cutting needle.....

Other Characteristics:

- Needle size
 - Needle insertion
 - Bevel direction
 - Number of attempts
 - Operator experience
 - Type of neurostimulation
 - Patient position
 - Traumatic vs. atraumatic tap
- Narrow gauge (Grade A: high)
 - Bevel parallel to spine (Grade B: moderate)
 - Fewer attempts (moderate)
 - Lateral decubitus patient position (moderate)
 - More experienced operator (minimal effect)

Treatment of PDPH

Preventive Measures:

1. Non-Pharmacologic

Pharmacologic

Interventional

Non-pharmacological
Measures:

- Bed rest
- Fluid therapy
- Abdominal binders
- Aromatherapy



Pharmacological Measures:

IV:

- Opioids
- Cosyntropin*
- Caffeine

PO:

- NSAIDS/Acetaminophen
- Fioricet
- Sumatriptan
 - Low levels breast milk
 - Poor oral bioavailability
 - 1 case of cessation of milk production

*RCT of 90 obstetric patients,
1 mg cosyntropin showed decrease
in:

PDPH (33% versus 68.9%)

EBP (11.1% vs 28.9%)

Hakim et al. Anesthesiology, 2010.

MAGNETIC RESONANCE IMAGING OF EXTRADURAL BLOOD PATCHES: APPEARANCES FROM 30 MIN TO 18 H

S. C. BEARDS, A. JACKSON, A. G. GRIFFITHS AND E. L. HORSMAN

MRI OF EXTRADURAL BLOOD PATCHES

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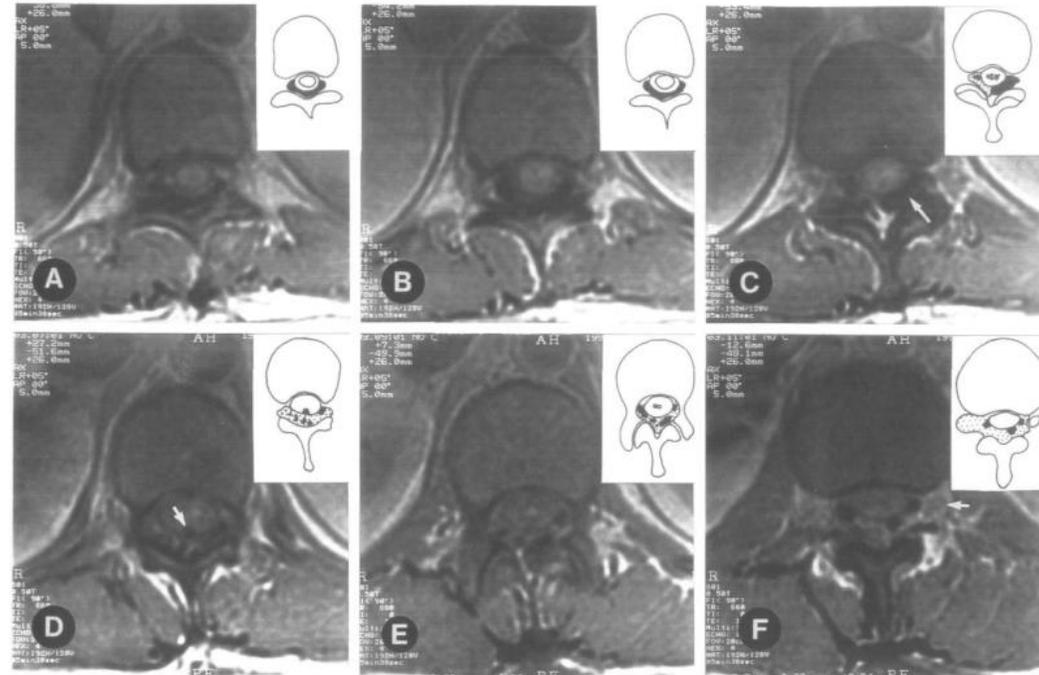


FIG. 1. A series of six axial T1 weighted GE images, demonstrating the distribution of blood within the extradural space in patient No. 2 (3 h after injection). The inset on each image shows the distribution of blood derived from both axial T1 and sagittal STIR images. Images are equidistantly spaced between T10 (A) and L3 (F). The arrow on C indicates clot extending out through the left neural outlet foramen. In D, the arrow indicates a small focus of clot lying within and adherent to the thecal sac. The arrow in F indicates the dorsal root ganglion displaced downwards and anteriorly by the extradural clot.

Epidural Blood Patch



- Clinical Diagnosis:
 - Consider red-flag headache symptoms before performing EBP
- Optimal volume of blood has not been established
 - Many practitioners use up to 20 mLs
- Common teaching is to enter at or 1 space below the level of the initial dural puncture

“In obstetric settings, most observational studies suggest that EBP failure (defined as requiring more than one EBP) is more likely if EBP is performed within 24-48 hours of dural puncture.”

References: 36 46 158 166 167 240 261 335 337 338 342 343 346 347 351–399 ; Uppal V et al, RAPM, 2023

- Confounders
 - severity of Headache
 - natural History of PDPH

Other procedural interventions we use to treat PDPH

Interventional Procedures:

- Intrathecal saline, opioids
- Epidural fluids (saline, dextran, hydroxyethyl starch, gelatin)
- Acupuncture
- Fibrin glue
- Sphenopalatine ganglion block
 - evidence does not support routine use





Anatomy and clinical positioning during sphenopalatine ganglion block procedure.

Source: Hung, K-C; BJA; 2021

Sphenopalatine ganglion block

- Proposed mechanism
 - Block of parasympathetic outflow from SPG causing cerebral vasoconstriction
 - Downregulation of inflammatory mediators
- Heterogeneity of:
 - Block techniques (applicator, spray, injection)
 - Frequency (single, repeated, continuous)
 - Local Anesthetic (composition and volume)
 - Adjunct therapy?
 - Assessment of efficacy (none, TCD's)

Greater Occipital Nerve Block

- Provide symptomatic relief
- Typically involve mixture of local anesthetic + steroid
- 5 RCT's, systematic review and meta-analysis
- All but one after spinal anesthesia
- Heterogeneous:
 - Block techniques (US, nerve stimulator, landmark)
 - Comparators (sham block, no block, SPG, EBP)
- Most had partial improvement, although 25% needed EBP

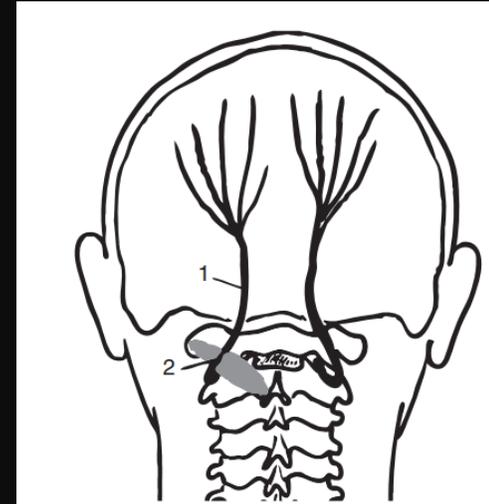


Fig 2 Schematic drawing of the course of the GON. 1, Classic block site medial to the occipital artery at the superior nuchal line; 2, new block site over the obliquus capitis inferior muscle (grey) at C2.



Fig 4 The anatomical dissection shows four injection sites. The upper two are at the classical block site at position 1 in Figure 2. The lower two are at the new block site at position 2 in Figure 2. The tips of all four needles are in the GON, and the nerve is coloured by ICG.

What procedural interventions may be used to treat PDPH?

Interventional Procedures:

- Acupuncture
- Epidural and spinal morphine
- Epidural crystalloids, dextran, gelatin, hydroxyethyl starch
- Fibrin glue
- Sphenopalatine ganglion block
 - evidence does not support routine use
- Greater Occipital Nerve Block
 - Recommendation:** *GONBs may be offered to patients with*
 - *PDPH following spinal anesthesia with a narrower gauge*
 - *(22G or less) needle, although headache may recur in a significant*
 - *proportion with more severe headache requiring an EBP*
 - (Grade C; Moderate Level of Certainty).*
- Prophylactic epidural blood patch
- Intrathecal catheter

What are the long-term complications of PDPH?

- Subdural hematoma
- Cerebral venous sinus thrombosis → (moderate)
- Chronic headache, backache, or neckache
- Cranial nerve palsy
- Postpartum depression



- PDPH was reported in 46 (79.3%) and an epidural blood patch was performed in 26 women (44.8%).
- Superior sagittal sinus, transverse sinus, and cortical veins were the most common sites of thrombosis.
- MRI: most common diagnostic neuro-imaging modality.
- Full neurological recovery was reported in 48 (82.8%), whilst neurological deficits were reported in six (10.3%) women

PAIN

Chronic headaches related to post-dural puncture headaches: a scoping reviewQianpian Zhang¹, Sing Y. Pang² and Christopher W. Liu^{1,3,*}¹Department of Pain Medicine, Singapore General Hospital, Singapore, ²Department of Anesthesiology, Singapore General Hospital, Singapore and ³Anesthesiology and Perioperative Sciences Academic Clinical Programme, Duke–NUS Graduate Medical School, Singapore*Corresponding author. E-mail: christopher.liu.w.y@singhealth.com.sg

- 12 cohort studies; 15, 863 patients
- pooled relative risk of chronic headache in patients with and without accidental dural puncture:
 - 1.9 (95% CI, 1.2-2.9) at 3 months
 - 2.5 (95% CI, 2.0-3.2) at 6 months
 - 3.6 (95% CI, 1.9-7.1) at 12 months
- 20 case reports of 49 patients who developed chronic headache after a dural puncture

ORIGINAL ARTICLE**Long-term psychological and physical outcomes of women after postdural puncture headache***A retrospective, cohort study*

Sharon Orbach-Zinger*, Leonid A. Eidelman*, Michal Y. Livne, Olya Matkovski, Eitan Mangoubi, Adi Borovich, Susan A. Wazwaz, Alexander Ioscovich, Zoya Haitov Ben Zekry, Karin Ariche and Carolyn F. Weiniger

Results:

- Postpartum Depression:
 - 67/128 (52.3%) vs. 31/275 (11.3%)
- PTSD
 - 17/132 (12.9%) vs. 10/275 (3.6%)
- Breastfeeding or back pain with or without epidural blood patch
 - 75/126 (59.5%) vs 212/276 (76.8%)
- Current headache and backache
 - 58/129 (44.9%) vs 58/275 (21.1%)

NO significant difference in incidence of PPD, chronic headache or back pain with or without epidural blood patch

Recommendations for follow-up

- Before discharge, information regarding **PDPH sequelae should be conveyed to patients** with arrangements for appropriate follow-up and contact information with their anesthesia provider and other health care providers (Grade B, Moderate Level of Certainty).
- The person (or team member) responsible for dural puncture leading to PDPH should ensure that **other specialties or primary care physicians are informed of PDPH management and potential for long-term symptoms** (Grade B, Moderate Level of Certainty).
- **Follow-up** with patients who experience PDPH **should be continued until headache resolves** (Grade B; Moderate Level of Certainty).
- Following discharge from hospital, **follow-up may be continued by the patient's primary care physician**. Information regarding PDPH diagnosis and/or inadvertent dural puncture should also be communicated to the patient's primary care physician **and other specialists with referrals to a pain or neurology specialist if indicated** (Grade C; Low Level of Certainty).
- **Urgent neuroimaging and referral** to an appropriate specialist should be performed for any PDPH patient **with worsening symptoms despite an EBP, new focal neurologic symptoms, or a change in the nature of headache** (Grade B; Moderate Level of Certainty).



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