

UPDATE IN POST-DURAL PUNCTURE HEADACHE: THE DO'S AND DON'TS?

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Post-Dural Puncture Headache (PDPH) is a well-known complication of intended dural puncture (anesthesia, diagnostic), catheterization (anesthesia, neurosurgery, pain therapy, oncology) or inadvertent dural puncture (epidural anesthesia, surgical). While anesthesiologists have anticipated this problem by using needles of smaller size and special design and radiologists have abandoned myelography, neurologists still have continued to use large bore Quincke needles.

Although the symptoms, preventive and treatment options are known for many years, some aspects may deserve special attention. Despite a tremendous amount of reports and reviews, the present contribution will mainly focus upon publications of the last five years while others will not be older than 10 years.

Symptomatology and diagnosis

The first event may be the free flow or aspiration of cerebrospinal fluid (CSF) though sometimes unrecognized. A high or total spinal may be another indication for a possible unintended intrathecal injection or communication between the extradural and subarachnoid space. In case of headache, the classical complaints include fronto-parietal headache in the first place but also neck pain, backache, nausea, vomiting, photophobia, diplopia (N. Abducens paresis), scotoma and tinnitus and other auditory disturbances (sometimes the sole finding without patient's notice). However when left untreated more serious complications have been described such as seizures, temporary blindness, posterior reversible encephalopathy syndrome, cortical

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vein thrombosis and subdural hematoma / hygroma (due to traction upon intracranial veins) and paralysis of nerves V and VII (1-4).

When performing a blood patch, free flow or aspiration of CSF following the loss of resistance may evidence leakage provided that it has not been caused by a new tap. Imaging techniques such as MRI of the puncture site or intracranial structures are of rather poor value and even misleading in helping in the diagnostics of CSF leakage.

Differential diagnosis

Not infrequently different etiologies have been mistaken for PDPH. PDPH may be confused with headache resulting from caffeine withdrawal, pre-eclampsia, meningitis, intracranial space occupying lesion (tumor or bleeding), cortical or venous sinus thrombosis, pneumocephalus, migraine, tension headache (5). Ondansetron seems to possibly cause headache mimicking PDPH. Due to this the anesthesiologist should be very critical when asked to perform an epidural blood patch (EBP). Especially when after a first EBP the headache persists a careful reappraisal should be performed before jumping into a second trial.

Prevention of PDPH

Besides a change in needle design (and less convincible the direction of the orifice) for spinal anesthesia no further precautions should be undertaken because the incidence of PDPH after such a procedure should be less than 1%. However when an unintentional tap has been performed with an epidural needle, the incidence may increase to more than 50%, more particularly in obstetric patients being very vulnerable for PDPH after delivery. Theories exist to prevent either the tap itself or the occurrence of PDPH. A loss of resistance to saline (LORS) may at least prevent the early type headache possible when air would enter the subarachnoid space by an accidental tap. Others have found that LORS may cause less accidental taps than air, the latter being progressively abandoned in favor of saline. Large retrospective studies have been able to demonstrate that Combined Spinal Epidural techniques may be less likely to cause a dural tap (6).

To prevent the occurrence of headache itself several possibilities have been suggested. It is still a common belief that the needle bevel may play a role more for the epidural than the actual spinal needles while also a specific Jonas maneuver during spinal needle insertion has been suggested to prevent PDPH. Whereas the supine position may exacerbate the complaints, it has been even recommended to resume this position as soon as possible (provided PDPH is not present yet) to allow the dura to fit better against the

bony structures of the spinal canal thus reducing CSF leakage.

Regarding a prophylactic blood patch a randomized study demonstrated that this was not effective in reducing PDPH or the need for EBP except for a somewhat shorter duration of the headache (7). Although recently it has been shown that nevertheless a prophylactic patch may be better than conservative or no treatment (8,9) it should be emphasized that performing them via the epidural catheter with orifices (not all of them will remain opened) located above the dural hole (considering that a second epidural will mostly be done one or more interspaces more cephalad) is not a good idea.

Placing the catheter intrathecally and leaving it in place for at least 24 hours has been considered for quite some time to be the best option to prevent the later occurrence of PDPH or at least to lessen the need for an EBP (10,11). However recent similar studies were unable to confirm this when proceeding to continuous spinal anesthesia (CSA). During the last decade several local (12,13) and nationwide surveys (14-20) have been published to examine the incidences of accidental taps and PDPH and which strategies are followed subsequent on these events. Despite some increase still many colleagues prefer to place the epidural at an adjacent interspace. In the most recent German survey less than 3 % proceeded with continuous spinal anesthesia (20). Anesthetists should take into consideration that a new tap may be performed while epidurally injected substances may tend to spread more cephalad either by subarachnoid migration or dilution by leaking CSF. So, even if the incidence of PDPH may not decrease with conversion to a CSA technique, this is no reason to reject the latter option. Some concern has been raised with respect to the possible damage caused by introducing epidural catheters intrathecally.

Finally it is unclear whether medication such as corticosteroids, neuraxial opioids, epidural postoperative analgesia or intrathecal saline are really useful as prophylactic measures against the development of PDPH (21,22). Also avoiding to mother to push during the second stage of labor (in favor of forceps or vacuum extraction) or reducing the duration of this stage has been shown to be less successful in reducing PDPH than previously suggested (15).

The treatment of PDPH

Although most handbooks recommend to start with hydration, caffeine, symptomatic drugs (opioids, NSAIDs, weak muscle relaxants, theophylline) some cases may not allow a rather long interval of conservative treatment with this treatment hoping that symptoms will resolve that way. Whereas conservative treatment may treat PDPH induced with small spinal needles,

it may be less realistic to believe that taps made with Tuohy needles in an obstetric population might be able to cure PDPH. Especially midwives insist on quite rapid performance of an EBP to allow mothers to remain mobile to take care of their neonate and allow discharge no later than uncomplicated cases. As a consequence, the interval between the initial complaints (with subsequent conservative treatment) and an EBP is around 24 hours and preferably no longer than 48 hours. The EBP remains the most aggressive but most successful treatment option with a higher success rate than epidural injection of saline, dextran or tissue glue. Other newer modalities consist of systemic medication with variable success (hydrocortisone, ACTH, sumatriptan, frovatriptan, cosyntropin, mirtazapine, gabapentin etc.), acupuncture and even stellate, sphenopalatine ganglion blocks and occipital nerve blocks (23-25).

The Epidural Blood Patch

Although the idea may seem attractive to perform the LOR technique to air (to make the distinction easier between recurring saline or CSF) the risk of pneumocephalus may make the treatment worse than the disease (26).

The epidural injection of autologous blood has a high success rate although less than initially reported. Although sealing the hole by a clot may seem to explain the resolution of the headache, it does not explain the almost instantaneous relief of symptoms because the restoration of CSF required several hours. Therefore sealing of the dural hole may consolidate the final success, the immediate effect will be caused by the increase of the ICP as a consequence of the epidural injection of the blood. Most of the blood will spread cephalad over at least 4-5 dermatomes while a considerable amount will flow back subcutaneously along the needle track. It is desirable to inject the blood as close as possible to the hole provided that it is clear where the puncture has been done or which of the punctures might have caused the tap. Although a volume of 15-20 ml seems optimal, some cases have been reported with volumes largely exceeding 30 ml while other reviews reported median volumes of only 10 ml (20). The injection should be stopped when the patients complains of low back cramping pain, pain in the legs or the head but there is a risk that this may occur at lower volumes than those recommended. Especially patients with mostly unknown spinal stenosis with a risk of mechanical compression of neural structures may be more likely to support smaller volumes than recommended. When the tap has been subsequent upon a difficult puncture, there is a considerable risk that a new tap may occur. However morbidly obese patients seem to be less at risk for PDPH while, in the author's experience, patients with previous spine interventions

may also be less likely to develop PDPH probably due to the scar tissue preventing CSF to leak in the fibrotic epidural space. There is still some concern with respect to patients suffering chronic pain or muscle spasm and treated with intrathecal drugs following which CSF may leak subsequent upon a catheter through needle placement.

Recently fluoroscopically (contrast medium diluted in the blood !), ultrasound (ocular sonography) and CT/MRI guided (unfortunately not real-time) performance of EBP has been reported particularly when a first EBP has failed to resolve the symptoms (27-30).

Despite overall reported safety of an EBP some complications should be considered. Reported untoward effects, especially after extremely large or repeated patches, have been bradycardia, backache, abcedation, pneumocephalus, cranial nerve V & VII paralysis, exacerbation of symptoms, arachnoiditis, radiculopathy, a new tap, intrathecal injection of blood etc. (31-35). Although there has been some fear that subsequent epidurals might fail either because of the CSF leak or the injected blood, this does not seem to preclude a high success rate.

Some challenging problems

Cervical taps

In chronic neck pain epidural injection of corticosteroids may offer some relief of the symptoms. Some spontaneous leaks have been reported as well. The CSF pressure upon a cervical hole may be less than at the lumbar level but sometimes an EBP may be mandatory. Success has been reported with EBP at the lumbar level although permanent relief of PDPH seems hardly to explain by a sealing mechanism as it does not seem realistic to believe that the blood will spread that far (36,37).

The infected patient

HIV positive subjects may receive an EBP while also a first trial with dextran may be suggested (38) rather than the injection of allogeneic blood as reported in patients with other systemic infections and fever (39,40). In case of fever untreated with antibiotics and local infection the EBP should be refused.

The child with PDPH

Although it occurs less frequently and is more difficult to diagnose than in the middle age population, cases of PDPH have been reported following

punctures, permanent catheters and taps in children. Other symptoms without PDPH such as nausea and vomiting may suggest CSF leakage. Epidural blood patch may be performed by the caudal route (41). No recommendations exist with respect to the volumes of blood to be injected.

The persisting headache

Despite EBP not all patients will be cured definitely. At least 25-30 % may have only partial relief while less than 20 % will not report any benefit (12-14). Most of the failures were observed in the obstetric population requiring a second patch. The success rate of a second patch is mostly not higher than 50%. A question for a third patch should be handled with even larger suspicion. Therefore the questions arise about optimal timing of EBP (too early in OB?) and the indications for a new patch. Also the interval between two patches may be subject of debate based upon described complications related to the total volume of blood and/or number of patches. A careful and critical appraisal is mandatory before such a patch should be performed and at least 24h should relapse between the first and second patch. When in doubt, an 'objective' neurological consult should be asked for while also a CT or MRI may be desirable to rule out other possibilities. Only when a persistent leak may be evidenced by imaging techniques, surgical repair may be considered.

As long as the complaints are less prominent than before the patch it may be evaluated as to whether the symptoms decrease with time. When the patient can assume the erect posture for at least 15 minutes, a new EBP should not be considered.

There is a lack of reports of patients suffering headache consistent with PDPH but lasting several months before an EBP had been offered. Occasional and partial successes have been reported with such patches performed up to seven years after the causal (?) event (42).

Formal complaints and litigation

As most of the formal complaints seem to be related to non-compliance with existing protocols, brutality of the anesthesiologist, delayed return to home or daily activity, it may be recommendable that hospitals should organize audits, make algorithms and protocols while anesthesiologist should remain friendly at all times a complaint might result from their intervention.

Summary (the do's and don'ts)

DO	DO NOT
Use spinal needles : pencil point <25G	Rotate/turn epidural needle > 90°
Convert to CSA if ADP, leave catheter >24h	Inject LA via Tuohy needle if ADP
Avoid Loss Of Resistance (LOR) to air	Resite epidural after ADP surely not at lower interspace
Inform patients (Informed Consent)	Wait too long for effect of conservative treatment if ADP
Be critical when asked for EBP (ΔΔ!) Consider risk / benefit of EBP	Use more than 3ml of saline for LOR in EBP
Perform EBP at lower level than ADP level	Allow CSF sampling or neuro-surgical intervention for diagnosis of headache
Use 15-20mL of blood, unless pain	Discharge patient if PDPH <50% improved
Respect strict sterility esp. with EBP	Apply 3rd EBP without brain imaging (CT, MRI), neuro-consult....
Avoid pushing (labor), cough.... (EBP)	Give additional caffeine in OB
Remain friendly	Inject blood via epidural catheter

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