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## Post-dural puncture headache: The worst common complication in obstetric anesthesia



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### ABSTRACT

Ever since the first spinal anesthetic in the late 19th century, the problem of “spinal headache” or post-dural puncture headache (PDPH) has plagued clinicians, and more importantly, patients. It has long been realized that the headache and other symptoms that often occur after the entry of a needle into the subarachnoid space is somehow related to fluid loss, although the exact pathophysiology of the headache has really never been defined. With the introduction of pencil-point spinal needles for spinal anesthesia in pregnant women over the past 2 decades, the problem of PDPH in obstetrics has been more associated with accidental dural puncture during attempted epidural procedures. Accidental puncture probably occurs in about 1% of procedures, so with over 60% of pregnant women receiving epidural analgesia for labor, there are probably 20,000–50,000 obstetric patients with PDPH in the United States each year. In this article, we will discuss the current state of knowledge in this area, suggesting that the PDPH syndrome is more severe and often more long-lasting, with some potentially life-threatening complications (cerebral hemorrhage) than usually appreciated or admitted. While prevention and treatment options are still limited, with the only clearly effective treatment being the epidural blood patch, recognition of the PDPH syndrome in postpartum women by anesthesiologists and obstetricians, with aggressive follow-up and treatment, may help limit the associated morbidity and mortality.

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Post-dural puncture headache (spinal headache, PDPH) is the most common serious complication resulting from lumbar punctures (diagnostic or therapeutic) and epidural or spinal anesthetics. Despite the prevalence of this condition, relatively little is known about its pathophysiology, and most accepted treatments are not evidence-based. While PDPH occurs in various clinical situations, this article will attempt to review the literature as it relates to the peripartum period.

### Incidence

In the United States, there were 4 million births in 2012,<sup>1</sup> and 61% of singleton vaginal births in 2008 received a spinal,

epidural, or combined spinal–epidural (CSE) procedure for labor analgesia. Extrapolated data suggests that greater than 2 million women will receive labor analgesia this year. The overall incidence of PDPH following spinal, epidural, or CSE is approximately 1% with typical obstetric anesthesiology practices. This reflects estimates of a 0.5–2% incidence of headache after planned spinal anesthesia/analgesia with small, pencil-point needles. In addition, when attempting epidural procedures with 16–18-gauge (G) epidural needles, accidental entry into the subarachnoid space (wet tap) occurs 0.5–4% of the time, with a resulting headache rate of 45–80%.<sup>2</sup> Therefore, we can conservatively expect greater than 20,000 postpartum women will experience a PDPH in the US in 2014.

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## Pathophysiology

The pathophysiology of PDPH almost certainly involves the leakage of cerebrospinal fluid (CSF) out of the intrathecal space. MRIs conducted on patients with PDPH show decreased CSF volume, sagging of intracranial structures, and meningeal enhancement attributed to vasodilation of vessels secondary to intracranial hypotension.<sup>3–5</sup> Despite MRI evidence of decreased CSF volume and pressure as the etiology, the exact mechanism of head pain remains unclear. Intrathecal hypotension may result in caudad excursion of the brain, which results in headache through traction on pain-sensitive areas of the brain and meninges. Alternatively, CSF loss may cause increased cerebral blood flow and vascular dilation, resulting in a pathophysiology similar to vascular headaches.<sup>6</sup> Recent investigational literature has examined the benefits of treatments designed and used for vascular and migraine headaches, including caffeine, theophylline, triptans (sumatriptan), and methylergonovine (as discussed in the section [Treatment](#)), although none of these therapies have been found to be universally effective in controlled studies. There is some evidence linking the pain to substance P and neurokinin 1 receptors.<sup>6</sup>

The spinal cord is bathed in CSF, and both are contained within the intrathecal sac, which is bordered by the meninges. The meninges are made up of three layers (dura, arachnoid, and pia mater), which are responsible for containment of CSF. CSF is located between the arachnoid and pia mater, with the dura superficial to the arachnoid mater. The term post-dural puncture headache (PDPH) is quite likely erroneous because a tear in the arachnoid matter, and not the dura, is the likely explanation for the clinical symptoms experienced.<sup>7</sup> The dura is composed of predominantly collagen fibers, and the relatively large molecular distances between fibers allow drug and fluid movement. By contrast, the arachnoid mater consists of tiers of cells attached by tight junctions and occluding junctions. This phenomenon results in the impedance of drug passage into the CSF and the containment of CSF in the subarachnoid space.<sup>7</sup> If in fact PDPH is caused by CSF leakage out of the intrathecal space, it seems logical that a tear in the arachnoid meninges is more important than the dura since this layer is primarily responsible for the containment of CSF around the spinal cord and brain. A more appropriate name would therefore seem to be post-arachnoid puncture headache, or spinal headache (less specific), although the actual importance of this distinction may not be clinically relevant. While acknowledging that the dura may not be the important barrier, in this review, we will use the term “dural puncture” and PDPH, as they are the familiar designations for the syndrome and almost universally used.

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## Diagnosis

Headache after childbirth is extremely common, occurring in 30% of women, ranging from benign to severe in severity and varying as much in etiology. The majority of postpartum headaches are caused by lack of sleep, caffeine withdrawal, tension, or migraine headaches.<sup>8,9</sup> When compared to the

general population, postpartum women without meningeal puncture are at increased risk of serious causes of headache, including subarachnoid hemorrhage. This occurs at a rate of 6 per 100,000 deliveries and may be related to increased plasma volume, vascular tone, alterations in the fibrinolytic system or coagulation cascade, or disseminated intravascular coagulation DIC.<sup>9,10</sup> Other serious etiologies for postpartum headache include cortical vein thrombosis, sagittal sinus thrombosis, preeclampsia/eclampsia, posterior reversible encephalopathy syndrome (PRES), and vasculopathy.

PDPH occurs within 72 h after meningeal puncture in 90% of patients and is evident by a headache typically worsening within 20 s of standing or sitting and resolving within 20 s of recumbency, although the International Headache Society (IHS) defines it as occurring within 15 min of standing and resolving within 30 min of recumbency.<sup>8,11</sup> Headaches probably occur earlier (both earlier after the puncture and earlier upon assuming a standing or sitting position) and are more severe after punctures with larger needles (e.g., “epidural” needles). If a postural component is not elicited, the diagnosis should be questioned. The IHS further defines the headache as self-limited, resolving within 14 days (usually less than a week), although it is clear that protracted cases occur with some patients requiring treatment years later, possibly more commonly with larger punctures, but reported with all size and shape needles.<sup>12</sup> The headache is usually dull in nature and frontal in location (75% of the time), but occipital pain also occurs which may, or may not, radiate into the neck and shoulder area. Associated symptoms occur in more than half of patients and include nausea, tinnitus, vertigo, and photophobia.<sup>2</sup> Large defects may result in significant CSF loss and intracranial hypotension, which cause caudad brain displacement with cranial nerve traction, and additional auditory, ocular, and vestibular symptoms. The most common auditory complication involves abnormal sound perception; decreased CSF pressure is transmitted to the inner ear, disrupts hair cells, and alters low frequency hearing.<sup>13</sup> Diplopia from traction on cranial nerve VI is not uncommon as well.

Although the diagnosis of PDPH is predominantly clinical, radiologic imaging can be useful to rule out other pathology or corroborate an unclear presentation. PDPH confirmation from magnetic resonance imaging consists of enhancement of the pachymeninges, decreased size of subarachnoid cisterns and cerebral ventricles, downward displacement of the brain, and subdural collections.<sup>4</sup> Alternate studies may include CT scan (with or without myelography), transcranial Doppler, or cerebral angiography. If the diagnosis is uncertain, or clinical features worrisome, neurologic consultation can be utilized before or after imaging is obtained. Unfortunately, a diagnostic spinal tap, which is often utilized in these scenarios, may worsen a preexisting PDPH, or cause a new PDPH, and delay or confuse diagnosis and treatment of the original problem. In our practice, we try to discourage a diagnostic LP until after imaging.

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## Clinical course and complications

While meningeal puncture is often not considered the most serious cause of headache following pregnancy, it is not a

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