Pearls and Oy-sters: Post-dural Puncture Headache, Cerebral Sinus Venous Thrombosis, and Reversible Cerebral Vasoconstriction Syndrome in the Peripartum

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Abstract
We report the case of a 34-year-old female patient complaining of headaches one day after childbirth, initially interpreted as post-dural puncture headache (PDPH) and treated successfully with an epidural blood patch. Five days later, she presented an acute proportional right sensorimotor hemisyndrome and a new onset left-sided headache, attributed to a venous stroke from left-sided cerebral sinus venous thrombosis (CSVT). Simultaneously, we found radiological signs of reversible cerebral vasoconstriction syndrome
(RCVS), considered as asymptomatic. We started the patient on anticoagulant therapy and she showed full motor recovery at the 3-month clinical follow-up.

PDPH, CSVT and RCVS are well-known neurological complications of the peripartum period. All three conditions present with headaches and headache features may overlap, masking co-occurrence and making accurate diagnosis (differentiation) of these diseases difficult. Each disease can potentially lead to disabling deficits, but all respond to specific treatment. Knowledge of the causes of headaches in the peripartum period, their specific clinical characteristics and potential complications helps to prioritize and interpret diagnostic tests to offer appropriate therapy.

**Pearls**

- A large variety of headache of frequent and rare etiology occur in the peripartum period.
- Excellent history taking and knowledge of clinical headache presentations will guide choice of diagnostic exams and their interpretation.
- The simultaneous presence of different headache etiologies in a peripartum patient should be considered.
- Detecting co-occurrence should prompt targeted treatment to reduce chances of complications.

**Oy-sters**

- New onset headache in the peripartum period must be considered as a red flag for secondary headache.
Proportional hemiparesis of upper and lower limbs cannot be explained by a small arterial cortical stroke as the respective limb representations are vascularized by two different arteries, the MCA and ACA.

Case report

A 34-year-old woman without previous medical history experienced orthostatic headaches following a vaginal delivery with epidural anesthesia, diagnosed as post-dural puncture headache (PDPH). As the patient was unable to care for her baby because of the pain, following current recommendations for the treatment of PDPH in the obstetrics setting two early epidural blood patches (EBPs) were performed that led to headache resolution within 72 hours. No imaging or measuring the cerebrospinal fluid opening pressure was performed.

Five days after the delivery, the patient presented to our emergency department because of sudden onset of paresthesia in her right arm and leg followed by weakness in these same extremities. Thirty minutes later a progressive moderate severity headache appeared that lateralized on the left side of the head.

On physical examination 180 min after symptoms onset, the patient had mild paresis of the right arm and leg. Vitals signs were normal, with no indication of elevated blood pressure at any time. Fundoscopic exam was normal. Brain MRI showed moderate diffusion restriction and hypoperfusion in the left precentral gyrus, interpreted as an acute arterial ischemic stroke (figure 1A-B). MR angiography (MRA) revealed irregularities of multiple segments of the intracranial arteries without significant stenosis or occlusion (figure 2A). We started IV thrombolysis with rtPA at 225 min after symptoms onset, with no clinical improvement.
The following day, the control MRI detected a parenchymal hemorrhage in the left precentral gyrus within the primary ischemic territory, without mass effect or clinical worsening. The MRI also showed venous thrombosis of a left frontal cortical vein (actually present on the baseline imaging) (figure 1C) and a new thrombosis of the left transverse sinus. MRA confirmed the persistent irregularities of the intracranial arteries (bilateral middle cerebral artery, left anterior cerebral artery), verified by Transcranial Doppler (TCD) exam that found increased flow velocity indicating more than 50% stenosis of the right anterior cerebral artery (figure 2B).

Our final diagnosis for the acute cortical lesion was a venous infarct, as the lesion was adjacent to the cortical vein thrombosis and the distribution did not respect an arterial territory but involved both the superficial MCA and ACA territories. Further work-up included lumbar puncture (LP) and blood examinations for prothrombotic state and vasculitis, and both exams were normal. While a second LP carried the risk of aggravating the PDPH, due to the combination of intracranial arterial stenoses, small hemorrhagic infarctions and cerebral venous thromboses, we considered it vital to exclude possible vasculitis. Indeed, a diagnosis of vasculitis would have required other therapeutic management, with delay or misdiagnosis potentially leading to a negative effect on patient prognosis. The headache did not increase after the second LP.

We diagnosed the arterial irregularities as reversible cerebral vasoconstriction syndrome (RCVS). We started the patient on oral anticoagulation with 5 mg of apixaban twice a day but gave no drugs for vasospasms, considered asymptomatic.
Serial TCD images showed spontaneous regression of the intracranial stenoses, and after 8 days, we discharged the patient home with no neurological deficits. The repeat MRI three months later showed a hemorrhagic scar at the site of the venous infarction, no new lesions and a complete resolution of the CSVT and arterial abnormalities. Anticoagulation was stopped.

**Discussion**

We report the case of a young woman who, in the week following delivery, presented recurrent headaches leading to the discovery of three different and possibly unrelated neurological complications: post-dural puncture headache, followed by CVST complicated by a venous infarct and asymptomatic RCVS, all of which can present with headache.

Headache is a frequent symptom in the postpartum period, with a prevalence ranging from 11 to 80%, mostly due to primary headache. However, the onset of a new or unusual headache in the peripartum period should be treated as a red flag for secondary causes of headache. This period is associated with an increased risk of several conditions presenting with headache, including cerebrovascular diseases (subarachnoid hemorrhage, ischemic or hemorrhagic stroke, CVST, cervical artery dissection and RCVS) and other causes (posterior reversible encephalopathy syndrome, eclampsia and pre-eclampsia, PDPH and pituitary apoplexy). On the other hand, the high incidence of headache in the peripartum justifies radiologic investigations only in patients with unexpected presentations, and using a stepwise approach as in our patient.

While PDPH is the most frequent etiology of secondary headache in the postpartum setting, appearing in up to 5% of pregnancies, the other possible etiologies should be kept in mind.
Roughly 0.004 to 0.01% of pregnancies are complicated by CVST that causes about 2% of pregnancy-associated strokes. CVST happens mainly in the peripartum, probably due to acute changes in coagulation factors and hormones and rapid fluctuations in intracranial pressure during delivery.

CVST requires acute anticoagulation, which should be initiated even despite a hemorrhagic venous infarct as seen in our patient, and outcome is usually favorable (no or minor disability in 94%).

PDPH and CVST share common clinical features, which may complicate differential diagnosis. CVST can present with headaches only, with focal neurological deficits occurring later or not at all. CSVT consequent to dural puncture during epidural catheter placement has been reported although a causal relationship is still unclear. CVST has also been described in up to 1-2% of patients with spontaneous intracranial hypotension (SIH). In this context, venous engorgement, traction on cerebral sinuses from brain sagging and increased blood viscosity have been proposed as mechanisms favoring CVST. We could hypothesize similar mechanisms promoting CVST following dural puncture.

EBP has been suggested as a treatment for CVST in spontaneous intracranial hypotension; therefore, we cannot rule out that the first headache on day one postpartum was the result of CVST and that the two blood patches temporarily relieved the symptoms of thrombosis.

Further complicating our patient’s case, MRI angiography revealed transient arterial anomalies and TCD examination exposed blood flow acceleration, indicating RCVS. There are only a few reports of cases of PDPH coexisting with RCVS and CVST with no obvious causal links between them. Currently, a connection between cerebrospinal fluid leakage and cerebral vasospasm is not clearly established, despite a few published cases suggesting
intracranial hypotension precipitating vasospasm. If this hypothetical association exists, we could suppose that the intracranial hypotension following the lumbar puncture may have been the primum movens of both the RCVS and CVST seen in our patient, although further studies are needed to ascertain a causal relationship.

RCVS was formerly known as postpartum angiopathy (PPA) occurring in the six weeks following delivery, and its pathogenesis remains unknown. Postpartum RCVS is usually self-limiting with resolution of symptoms and angiographic abnormalities within 3 days to 3 months. However, in severe cases it can cause ischemic stroke, brain hemorrhage and/or reversible parenchymal edema. RCVS typically presents with recurrent bouts of sudden extreme headache, sometimes accompanied by focal neurological symptoms. If serious, postpartum RCVS should be treated with nimodipine and perhaps intra-arterial antispastic drugs and balloon angioplasty. In the present case, we considered the RCVS as an incidental finding, as the characteristics of the initial and later headaches seemed better explained by PDPH and CSVT, respectively, and we did not administer any of the treatments as the vasospasms were asymptomatic and relatively mild.

At the initial evaluation in the emergency department we considered that the patient had an ischemic stroke due to a small cortical diffusion restriction on the MRI (figure 1), and treated the patient accordingly with IV thrombolysis. However, a proportional hemiparesis as seen in our patient would be expected from a deep territory stroke, such as stroke in the internal capsule or brainstem, and the ischemic lesion in the cortical territory of figure 1 would rather provoke a focal motor deficit, limited to the cortical representation corresponding to the affected cortical area.
In summary, our patient presented with postpartum headache initially attributed to, and successfully treated as PDPH. The patient then developed hemiparesis followed by a new, contralateral headache from a cortical venous infarct provoked by CVST, and finally, we found presence of radiological (but asymptomatic) RCVS.

Clinicians should therefore be conscious of the possible co-occurrence of multiple etiologies of postpartum headache and carefully evaluate and correlate all neurological symptoms using appropriate diagnostic exams. Early and correct identification of treatable causes of postpartum headache should help void complications and long-term sequelae.

References


Figure 1 – Pre- (A-C) and post- (D) intra venous thrombolysis (IVT) MRI images indicating:

1A. Diffusion Weighted Imaging (DWI) sequence showing a hyperintense signal around the edge of the central sulcus (arrow).
1B. TMax perfusion map showing the prolonged time to maximum perfusion in the corresponding area.
1C. Susceptibility weighted imaging (SWI) sequence showing a cortical vein thrombosis
1D. Susceptibility weighted imaging (SWI) sequence showing a hemorrhagic transformation
Figure 2 – MRI Angiography and Transcranial color-coded Doppler examination showing

2A. Time of Flight angiography (TOF) sequence showing multiple intracranial stenoses (arrows)
2B. TCCS (transtemporal approach) color mode (left) with corresponding Doppler spectrum (right). Upper row: anterior coronal plane, increased PSV and EDV and turbulent flow corresponding to a left ACM stenosis > 50%. Lower row: axial midbrain plane, increased PSV and EDV and turbulent flow, corresponding to a right ACA stenosis of > 50%.

PSV = Peak Systolic Velocity; EDV = End-diastolic velocity; ACM = Middle cerebral artery; ACA = Anterior cerebral artery
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