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Subdural Hematoma Associated With Labor Epidural Analgesia: A Case Series

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Abstract

Objective—This report describes the characteristics and impact of subdural hematoma (SDH) after labor epidural analgesia.

Case Reports—Eleven obstetric patients had subdural hematomas (SDH) associated with the use of labor epidural analgesia over 7 years at a tertiary care hospital. Ten of 11 patients had signs consistent with post-dural puncture headache (PDPH) prior to the diagnosis of SDH. Five patients (45%) had a recognized unintentional dural puncture, 1 (9%) had a combined spinal-epidural with a 24-gauge needle, and 5 (45%) had no recognized dural puncture. For 10 of the 11 cases, SDH was diagnosed an average of 4.1 (range 1–7) days after performance of labor epidural analgesia; one case was diagnosed at 25 days. Ten of 11 (91%) cases had a second hospital stay for an average of 2.8 (range 2–4) days for observation, without further requirement for neurosurgical intervention. One case (9%) had decompressive hemicraniectomy after becoming unresponsive. The observed rate of labor epidural analgesia-associated SDH was 0.026% (11 in 42,969, about 1:3900), and the rate of SDH was 1.1% (5 in 437, about 1:87) if a recognized dural puncture occurred during epidural catheter placement.

Conclusions—SDH after labor epidural anesthesia is rare, but potentially more common than historically estimated. Cases of PDPH after labor epidural anesthesia should be monitored closely for severe neurologic signs and symptoms that could herald SDH.

Keywords

Subdural; postdural puncture headache; anesthesia; obstetric; labor

INTRODUCTION

Unintentional dural puncture (UDP) with subsequent post-dural puncture headache (PDPH) is a well-recognized complication of epidural anesthesia. Intracranial subdural hematoma (SDH) is a rare but sometimes serious complication of neuraxial procedures. Cases of SDH

have been reported following diagnostic lumbar puncture,¹ spinal anesthesia,² and UDP during epidural placement.³ A diagnosis of SDH is complicated by the fact that the symptoms of PDPH and the symptoms of SDH often share similar initial clinical presentations. Among parturients, the clinical picture is complicated further by a wide differential diagnosis that ranges from clinically innocuous entities such as normal postpartum headache, tension headache, and caffeine withdrawal, to clinically severe diagnoses including preeclampsia, posterior reversible encephalopathy, cortical vein thrombosis, undiagnosed Chiari malformation, and meningitis.⁴ SDH following UDP is a rare event with unclear clinical significance, with a quoted incidence of 1:500,000 to 1:250,000.^{5, 6} Presented here is a series of eleven cases of SDH at a high-volume tertiary care women's hospital, each of which was associated with labor epidural analgesia. The purpose of this case series is to describe the characteristics associated with the development of SDH after labor epidural analgesia and specifically after UDP, and to estimate the rate of occurrence of SDH under these conditions.

CASE REPORTS

The University of Pittsburgh Institutional Review Board does not consider the reporting of cases to be human subjects research, and a review of this activity was not required. The patients presented in this series gave verbal consent to share the details of their cases. For patients who could not be reached, the information has been generalized as much as possible and adequate time has been allowed to elapse, in order to maximize protection of their identity. All patients had the opportunity to review this report. These cases were identified using our institution's detailed quality assurance complications catalogue. In this catalogue, obstetric anesthesia cases resulting in complications that deviate majorly from expected clinical course are prospectively logged. Diagnosis, demographic information, background, objective testing results, and qualitative information gleaned from our institution's quality assurance committee reviews are recorded. For the purpose of this study, any case details that were missing or not recorded in this catalogue were gathered and noted from the medical record.

During the time period (2008 – 2015) eleven cases of SDH occurred. Tables 1 and 2 summarize details of these cases, and Appendix A provides detailed descriptions for each case (Supplemental Digital Content 1). During this time, 42,969 labor epidurals were placed and 437 dural punctures were observed. Based on our data, the estimated rate of SDH following labor epidural is approximately 0.026%, or 1:3900, and if a recognized dural puncture occurs during placement, the rate is 1.1%, or 1:87. Approximately half of the cases of SDH occurred in patients without a recognized dural puncture during epidural catheter placement. Therefore, these calculated rates may under-estimate the true risk for SDH after labor epidural anesthesia in the postpartum period. At the same time, these cases occurred at an academic institution that is a major referral center for high-risk births in a tri-state area. Thus, because the rates of complications at our institution may in fact be increased compared with the general population by virtue of our more complicated case mix, it is possible that these calculated rates over-estimate the true risk for SDH after labor epidural anesthesia in the postpartum period.⁷

DISCUSSION

While isolated cases of SDH after dural puncture have been reported, we are unaware of any case series for this rare complication being meticulously described after neuraxial anesthesia. In our series, all but one patient had symptoms consistent with PDPH and recovered without neurosurgical interventions, while one had devastating neurologic sequelae soon after complaining of a sudden headache and exhibiting an acute change in mental status. Cuypers et al⁸ recently accounted a thorough review of the literature, in which 56 cases of subdural hematoma associated with the use of neuraxial anesthesia in the obstetric population were identified. Those findings indicate that headaches in the postpartum period that are not consistent with PDPH, could be the most common heralding sign of clinically significant intracranial pathology, occurring in 83% of patients with SDH following neuraxial anesthesia. Our series supports this idea, and we additionally conclude that PDPH symptoms alone, without other serious neurologic symptoms, may be accompanied by clinically innocuous intracranial bleeding more often than previously supposed.

The detailed narratives describing each of these 11 cases adds to an understanding of the characteristics of labor epidural anesthesia-associated SDH. This series describes cases that took place at a single tertiary teaching facility with an obstetrical service of approximately 10,000 births a year, of which approximately 7,000 labor epidural anesthetics are performed annually. While this was not a population-based study, the large group from which these cases were abstracted may support a more accurate estimation of risk for SDH associated with labor epidural analgesia compared to previous reports. Although prior published data has placed the rate of neuraxial-anesthesia associated SDH in the obstetric population at 1:250,000 to 1:500,000,^{5, 6} our report suggests that the estimated rate of SDH following labor epidural may be approximately 0.026%, or 1:3900, and if a recognized dural puncture occurs during placement, the rate may be as high as 1.1%, or 1:87. The limitations of calculating these rates from an single academic center with disproportionate high-risk deliveries must again be noted.

The cases in this series suggest that the occurrence of SDH after labor epidural analgesia may be more common than previously reported, particularly if labor epidural analgesia is associated with UDP. Based on a review of the cases presented, we have identified ways to potentially mitigate against disruptions to patients and their families after detection of labor epidural anesthesia-associated SDH: 1) maintain close contact with patients who have a recognized UDP or who develop PDPH, in order to counsel each patient on the appropriateness of escalated management by EBP; 2) offer EBP early in cases of PDPH that is refractory to conservative management, while recognizing and counseling on the possibility for a need for repeat EBP in cases where the dural hole may be larger;⁹ 3) utilize the smallest possible pencil point gauge spinal needle for subarachnoid access;^{10, 11} and 4) reserve the performance of head imaging by CT or MRI to cases of postpartum headache that do not fit ICHD-II criteria for PDPH.¹²

Characteristics of patients, anesthetics, obstetric outcome, and timing of SDH diagnosis that were observed in our series are summarized in Tables 1 and 2. Most SDH occurred without

coexisting hypertensive disorders or coagulopathies. Four out of the 9 patients did not have a recognized dural puncture, but a dural puncture need not be recognized in order for PDPH to occur.¹³ None of the patients had a diagnosed coagulopathy at the time of SDH recognition. Two had pre-eclampsia, one had risk for hypercoagulability (MTHFR mutation), and the remaining were healthy. The timing of SDH diagnosis did not appear to affect treatment course and patient outcome.

One patient had a CSE for her labor and delivery. The dural puncture occurred with a 24-gauge spinal needle. Several studies have evaluated the risk of PDPH with various spinal needle sizes and have underscored the importance of using small gauge spinal needles (25-gauge or smaller) if a CSE technique is to be used; this case reaffirms these findings.^{10, 11} This patient was also 1 of 2 preeclamptic patients in this series. Preeclampsia is an independent risk factor for intracranial hemorrhage with an odds ratio of 10.4 (95% confidence interval, 8.3–13) for hemorrhagic stroke.¹⁴ Therefore, while neuraxial anesthesia was associated with the evolution of SDH in this case, causality cannot be established especially when considering this additional risk factor.

One patient in this series received labor epidural analgesia and had devastating neurologic sequelae secondary to the SDH and required decompressive craniectomy on postpartum day 1. While this particular case was associated with labor epidural analgesia, no recognized dural puncture occurred, and it is ultimately uncertain the significance that the neuraxial technique played in this patient's poor outcome. Air was noted in the cranial ventricles on CT examination. The most obvious source of this could have been the neuraxial technique, particularly considering that loss of resistance occurred with air. On the other hand, iatrogenic pneumocephalus is a common phenomenon that is often benign without requiring further treatment.¹⁵ Another possible mechanism considering this patient's mode of delivery, is venous air embolism (VAE); cesarean delivery is a high risk surgery for VAE, as uterine sinuses are vulnerable to the entrance of air particularly during extraction of the placenta.¹⁶ Five of the 11 cases in our series had a cesarean delivery. She also had a history of hypercoagulable state with a known MTHFR gene mutation, and the postoperative diagnosis at the time of primary hemicraniectomy was a hemorrhagic conversion of a venous infarct. The venous infarct could have occurred as a result of severe intracranial hypotension from dural puncture, leading to increased stasis in the temporal bridging veins, in the context of a patient who was already predisposed to abnormal clotting given her hyper-homocysteinemia and recent pregnancy status. Elevated homocysteine levels also carry an independent risk for venous thrombosis and cerebrovascular accident that is twice at of the general population (0.2% elevated homocysteine population vs. 0.1% general population).¹⁷ Thus, her clotting history, recent pregnant status and cesarean delivery, perplexes the impact that her labor epidural analgesia may have had on her poor neurological outcome.

At the time of SDH diagnosis, 10 cases presented in this series presented with a headache that was exacerbated upon upright positioning, and that was accompanied by either nausea, vomiting, photophobia, or neck stiffness. Thus, all but one of the headaches in this series were consistent with PDPH by the International Classification of Headache Disorders-II (ICHD-II) criteria.¹² ICHD-II criteria for PDPH specifies that all of the following be met: 1) the headache worsens within 15 minutes of sitting or standing, improves within 15 minutes

of lying; 2) the headache is accompanied by at least one of the following: neck stiffness, tinnitus, hypacusia, photophobia, and/or nausea; 3) the headache develops within 5 days after a dural puncture; and 4) the headache resolves either spontaneously within 1 week or within 48 hours after effective treatment of the spinal fluid leak, usually by epidural blood patch. Nine of the 11 patients received an epidural blood patch upon initial presentation of headache. Ten of 11 patients did not require neurosurgical intervention but did require additional hospitalization for observation, and some underwent additional tests and procedures.

As with previous reports, the estimation of SDH risk associated with labor epidural anesthesia in this series needs to be interpreted with caution. As mentioned, two of the cases involved other co-morbidities that could have independently conferred risk for SDH. Our report is also limited in terms of generalizability, selection bias, and lack of ability to establish a cause-and-effect relationship between epidural analgesia and SDH. The retrospective nature of this report also limits the ability to control the inaccuracies and deficiencies associated with documentation in the electronic medical record. Finally, while we have attempted to be as comprehensive as possible in including all cases of SDH related to labor neuraxial anesthesia over the time period by using our department's detailed quality assurance complications catalogue, it is possible that some SDH cases may have been missed.

We conclude that SDH associated with PDPH may be more common after labor epidural analgesia than previously reported. Most cases of SDH diagnosed after PDPH do not manifest with significant additional neurological changes beyond the typical clinical symptoms of PDPH. To avoid the disruptions associated with this complication, patients who have PDPH after labor epidural analgesia should be closely followed for signs that could signal the evolution of SDH.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Demographics, characteristics of labor analgesia and obstetric outcome.

Case	Age (years)	G	P	BMI (kg/m ²)	EGA (weeks)	LOS1 (days)	LOS2 (days)	History of Headache	Pre-eclampsia	Past Medical History	Labor Analgesia	Attempts (number)	Recognized UDP	Mode of delivery (Anesthesia type)	EBL (mL)
1	28	2	1	53.2	37	5	3	Yes	Yes	DM2	CSE	1	--	CD (CSE)	1100
2	34	1	0	36.7	41	5	4	No	No	Hypothyroidism, ITP	E	2	No	CD (E)	2300
3	38	1	0	29.3	41	4	3	Yes	No	None	E	3	No	CD (E)	700
4	30	3	2	25.3	38	4	2	No	No	None	E	2	Yes	SVD (E)	300
5	34	3	2	24.1	39	2	2	No	No	None	E	1	No	SVD (E)	300
6	30	1	0	25.3	38	3	3	No	No	Ulcerative Colitis	E	1	No	SVD (E)	300
7	31	1	0	25.7	40	4	2	No	No	None	E	2	Yes	CD (GA)	1000
8	33	3	2	29.4	40	4	1	No	No	Crohn's Disease	Intrathecal Catheter	1	Yes	SVD (E)	200
9	24	2	0	32.9	41	3	4	No	No	None	E	3	Yes	SVD (E)	300
10	30	1	0	19.7	37	4	3	No	Yes	None	E	2	Yes	SVD (E)	300
11	31	3	1	28.5	39	1	13	No	No	MTHFR, hypothyroidism	E	1	No	CD (E)	800

G = Gravidity; P = Parity; EGA = Estimated Gestational Age; BMI = Body mass index; LOS1 = Length of stay on first hospitalization; LOS2 = Length of stay on second hospitalization; UDP = unintentional dural puncture; EBL = estimated blood loss; DMII = diabetes mellitus type 2; ITP = idiopathic thrombocytopenia purpura; MTHFR = methyltetrahydrofolate reductase mutation; CSE = combined spinal-epidural; CD = cesarean delivery; E = epidural; GA = general endotracheal anesthesia

Table 2

Timing of symptoms and diagnosis.

Case	Headache	SDH Diagnosis [*]	Headache to Diagnosis [‡]	Blood Patch 1 [§]	Headache to Blood Patch	Blood Patch 2 [#]
1	2	6	4	6	4	--
2	0	25	25	22	22	--
3	3	3	0	3	0	--
4	0	4	4	0	0	2
5	1	2	1	2	1	--
6	2	5	3	3	1	6
7	3	6	3	4	1	--
8	1	4	3	2	1	4
9	2	7	5	--	--	--
10	0	3	3	1	1	4
11	1	1	0	--	--	--

^{*} Diagnosis = When imaging was performed, in days after neuraxial procedure
[‡] Headache to Diagnosis = Time between symptom development and imaging, in days after initial headache
[§] Blood patch 1= First blood patch performed, in days after neuraxial procedure
^{||} Headache to Blood Patch = Time between symptom development and performance of the first blood patch, in days after initial headache
[#] Blood Patch 2 = Second blood patch performed, if applicable, in days after neuraxial procedure
SDH = Subdural hematoma