ORIGINAL RESEARCH

EPIDURAL FILLING WITH CRYSTAL-COLLOID SOLUTION FOR POST ACCIDENTAL DURAL PUNCTURE HEADACHE: A CASE SERIES

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ABSTRACT

Purpose: Post dural puncture headache (PDPH) is a common anesthetic complication caused by expected spinal puncture or accidental dural puncture during intraspinal anesthesia operation. The purpose of this study was to retrospectively analyze the clinical features and outcomes of parturients with accidental dural punctures (ADP).

Methods: (All cesarean sections at the Chongqing Health Center for Women and Children (Chongqing, China) carried out under neuraxial anesthesia from January 1, 2017 to December 31, 2018 were reviewed and data from 20 parturients with ADP were collected and analyzed.

Results: Seventeen individuals received crystal-colloid solution fillers and three did not. The median epidural catheter retaining time was 40 hours; the median frequency of epidural filling was three times, with a median total volume of 60 ml. One patient developed tinnitus and three complained of head swelling during filling. The median bed-stay duration was 73 hours, with total intravenous infusion volume of 7.3 L in the first three postoperative days. Two patients complained of slight dizziness and mitigation, and five felt weak. One individual had intermittent headaches and dizziness till the seventh postoperative day.

Conclusions: Epidural injection of crystal-colloid solution, combined with hydration, maybe a useful preventive strategy for ADP-induced headache after cesarean section.

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INTRODUCTION

Although modern anesthesiology has changed dramatically in recent years, neuraxial anesthesia remains a popular option for cesarean sections to optimize maternal experience and fetus safety [1]. Post dural-puncture headache (PDPH) is a commonly reported anesthetic complication of central neuraxial block anesthesia and could results from expected spinal puncture or accidental dural puncture (ADP) following spinal or epidural block [2-5]. The incidence of PDPH after ADP varied from 10% to 80% in patients of different ages undergoing intrathecal block [6]. Intrathecal anesthesia is widely used in obstetric patients due to multiple factors, so PDPH is common in clinical practice and become the third reason for obstetric patients to sue anesthesiologists [7]. Martinez et al. reported among 66,540 epidurals for labor analgesia using 18G Tuohy needle, ADP occurred

in 510 patients, giving a cumulative incidence of 0.76%. Over half (59%) of the patients with ADP presented PDPH [8]. The pain that PDPH causes patients is far beyond the anesthesiologist's prediction, and active and timely prevention, detection and treatment is necessary to avoid serious complications. Cerebrospinal fluid (CSF) leakage is the most widely accepted cause of intracranial hypotension and is considered be the pathologic mechanism of PDPH. Many techniques have been developed to reduce CSF leakage caused by PDPH, and include drug or fluid administration through intrathecal catheterization [9], epidural blood patches (EBPs) and epidural hydroxyethyl starch (HES) patches. In this article, we reported the effects of epidural filling with crystal-colloid solution to treat ADP-induced headache undergoing cesarean section in a series case.

METHODS

The study was approved by the committee on ethics of Chongqing Health Center for Women and Children (Chongqing, China). All the cesarean sections carried out under neuraxial anesthesia from January 1, 2017 to December 31, 2018 in the single center were reviewed and twenty parturients with ADP were retrospectively analyzed.

All 20 reviewed patients received combined spinal-epidural anesthesia before undergoing cesarean section. The same procedure of spinal-epidural anesthesia was standardized as follows: a 25G lumbar puncture needle was inserted by an 18G epidural puncture needle guide after completion of epidural puncture. The needle core was withdrawn when the arachnoid membrane was punctured. Ropivacaine (0.5%; heavy specific gravity) was compound for spinal anesthesia, and an epidural catheter (3 cm through the needle mouth) was placed for epidural administration after withdrawal the lumbar puncture needle.

ADP was defined as 18G epidural puncture needle punctured arachnoid unexpected and confirmed by warm cerebrospinal fluid flowing out of or ejected from the tail of the epidural puncture needle. An ADP-induced headache was defined as complain of a post dural headache; namely, worsening pain when they are sitting up or standing and relief when they are recumbent [10]. The epidural filling treatment was as follows: when ADP was confirmed, the puncture needle was backed away immediately and the epidural catheter was retained for solution filling by the end of cessation operation. A 1:1 crystal (0.9% sodium chloride) and colloid (gelofusine) solution (self-compounding in proportion) (20–30 ml) was injected into the epidural space through the epidural catheter—taking about five minutes. Parturients were instructed to lay flat in bed without pillows and were given daily intravenous hydration treatment for at least three days.

RESULTS

The total number of cesarean sections carried out in the institution under neuraxial anesthesia in the period was 14,740. Of the patients who were confirmed with ADP, 17 received epidural filling treatment. Thus, the overall incidence of ADP was 0.14% (20 cases out of 14,740). The demographics, treatment and outcome information of all 20 parturients with ADP are shown in Table 1.

Among the 17 patients who received epidural filling treatment with the crystal-colloid solution, nine switched to subarachnoid anesthesia at contiguous intervals and the other eight received low concentration epidural anesthesia (repeated injections of 0.5% ropivacaine; administered slowly) at the same intervals to complete the surgery.

Of the 17 cases who were treated with the crystal-colloid solution, only one complained of intermittent headaches and dizziness and could not sit or stand up until the seventh postoperative day. Thus, the incidence of ADP-induced headache in these parturients was $n=1/17$ (5.88%).

Of the three cases who did not receive the filling treatment, one was switched to general anesthesia and treated conservatively with hydration (average 2.87 L per day during the first three postoperative days) and bed rest (91 hours). This patient reported no complaints when sitting or standing. The other two patients who did not receive epidural filling—or any other specific treatment—both complained of severe headaches on getting out of bed on the first postoperative day. This symptom worsened when they were sitting or standing and improved when recumbent. Headaches lasted until the eighth postoperative day in one case and to the fifth postoperative day in the other.

Follow-up at four weeks showed no PDPH recurrences or neurologic sequelae among any of the reported cases.

DISCUSSION

Following a retrospective review and analysis of two years of outcomes following parturient anesthesia in a single center, this study found that 1) the overall ADP incidence was low (0.14%) and 2) epidural injection of 1:1 crystal-colloid solution, combined with rehydration and bed rest, was effective as a strategy for PDPH prevention.

The incidence of PDPH has decreased dramatically from ~70% to ~1% over the past century due to the use of multiple preventive treatments [11]. The risk factors of PDPH include age, female sex, pregnancy, oblique plane of needle insertion, repeated dural punctures, previous history of PDPH and size or type of needle used [12–16]. Methods that address CSF balance may be theoretically effective in preventing PDPH because CSF leakage is widely accepted as the main reason. Epidural filling with saline or dextran has been suggested previously [17] and filling with materials such as EBP, HES and saline boluses or infusions has produced similar effects and has proved to be effective for PDPH patients [18–20].

Bed rest combined with rehydration was also shown to be useful for the prevention of PDPH—although this conclusion was based on the results from only two patients. Leakage of CSF will cease spontaneously with time so conservative therapy is also recommended for PDPH.

Pre-operative communication is essential to inform patients that ADP is a common complication and will result in prolonged bedrest and hospital stay. For patients with anxiety caused by ADP or ADP-induced headaches, psychological support is also necessary [21].

TABLE 1.
CLINICAL FEATURES OF PARTURIENTS.

	Patients treated with crystal-colloid solution (n=17)	Patients treated only with bed rest/hydration (n=3)		
		Case 1	Case 2	Case 3
Age (years)	30.24±3.80	28	31	29
Gestation (weeks)	39.29±1.13	40.57	38.43	39.43
Height (cm)	158.15±3.44	164	152	152
Weight (kg)	65.32±8.89	67	54.5	66
Baseline systolic pressure (mmHg)	114.00±8.51	116	116	111
Baseline heart rate (beats/min)	88.35±9.04	110	88	115
Intervertebral space punctured (L2-3/L3-4)	6/11	L3-4	L3-4	L3-4
Anesthesia method	SA at contiguous intervals (n=9) Low [EA] at the same interval (n=8)	SA	SA	GA
Fill frequency	3 (1-4)			
Total fill volume (ml)	60 (20-90)			
Symptoms during filling				
Tinnitus	1			
Head swelling	3			
Time in supine position (hours)	73 (40-90)	12	16	91
Total intravenous infusion volume during first 3 days (L)	7.3 (2.6-10.0)	5.1	3.5	8.6
Time epidural catheter retained (hours)	40 (22-50)			
Postoperative hospitalization length (days)	4 (3-11)	9	5	5
Symptoms on taking an upright position		*	†	No
Slight dizziness	2			
Weakness	5			
PDPH	1‡	Yes	Yes	No

Abbreviations: EA, epidural anesthesia; GA, general anesthesia; PDPH, post dural puncture headache; SA, subarachnoid anesthesia. Data are presented as the mean ± standard deviation or median (minimum- maximum).

* Case 1 complained of a severe headache on getting out of bed on the first and second postoperative days. Pain worsened on sitting or standing and improved when recumbent. Symptoms persisted until the eighth postoperative day.

† Case 2 complained of a severe headache after getting out of bed on the first postoperative day. This worsened when sitting up and improved when recumbent. Symptoms persisted until the fifth postoperative day.

‡ One patient retained an epidural catheter for 50 hours and was given four filling treatments with a total fill volume of 80 ml. This case received conservative treatment of hydration (average 2.73 L per day for the first three postoperative days) and bed rest, remaining supine for 72 hours. This individual tried a semi-recumbent position on the fourth postoperative day but felt weak and dizzy. She was reluctant to get out of bed due to fear of incision and lumbar pain. She complained of a headache after neck rotation for six postoperative days; headache was localized to the occiput and crown. Neurological examination was normal and there was no nuchal rigidity. She complained of intermittent headaches and dizziness until the seventh postoperative day. She tried to sit on the eighth postoperative day and had no observable symptoms on day eight or nine. The patient was discharged on the eleventh postoperative day.

The limitations of this study include the following: 1) small sample size, 2) the retrospectively design and 3) only three cases were given conservative therapy. Larger perspective studies and/or randomized clinical trials are needed to clarify the effectiveness of these preventive strategies.

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REFERENCES

1. Cwik J. Postoperative considerations of neuraxial anesthesia. *Anesthesiol Clin*. 2012; 30(3):433-443.
2. Bordlee JW, Beakley BD, Mody R et al. A case of paradoxical presentation of a postural postdural puncture headache after combined spinal-epidural anesthesia. *J Clin Anesth*. 2017; 38:156-157.
3. Bezov D, Ashina S, Lipton R. Post-dural puncture headache: Part II--prevention, management, and prognosis. *Headache*. 2010; 50(9):1482-1498.
4. Shea K, Choi L, Jagannathan D, et al. Accidental dural puncture during labor analgesia and obstetric outcomes in nulliparous women. *Int J Obstet Anesth*. 2019; 38:46-51.

5. Uluer MS, Sargin M, Akin F, Uluer E, Sahin O. A randomized study to evaluate post-dural puncture headache after cesarean section: Comparison with median and paramedian approaches. *Niger J Clin Pract.* 2019; 22(11):1564-1569.
6. Bezov D, Lipton RB, Ashina S. Post-dural puncture headache: part I diagnosis, epidemiology, etiology, and pathophysiology. *Headache.* 2010; 50(7):1144-1152.
7. Sachs A, Smiley R. Post-dural puncture headache: the worst common complication in obstetric anesthesia. *Semin Perinatol.* 2014; 38(6):386-394.
8. Martinez B, Canser E, Alonso A, et al. Postdural Puncture Headache and Epidural Blood Patch in a Large Obstetric Anaesthesia Population. *Asian J Anesthesiol.* 2018; 56(1):23-32.
9. Kuczkowski KM, Benumof JL. Decrease in the incidence of post-dural puncture headache: maintaining CSF volume. *Acta Anaesthesiol Scand.* 2003; 47(1):98-100.
10. Headache Classification Subcommittee of the International Headache S. The International Classification of Headache Disorders: 2nd edition. *Cephalalgia.* 2004; 24 Suppl 1:9-160.
11. Waise S, Gannon D. Reducing the incidence of post-dural puncture headache. *Clin Med (Lond).* 2013; 13(1):32-34.
12. Kuczkowski KM. Post-dural puncture headache in the obstetric patient: an old problem. New solutions. *Minerva Anesthesiol.* 2004; 70(12):823-830.
13. Amorim JA, Gomes de Barros MV, Valenca MM. Post-dural (post-lumbar) puncture headache: risk factors and clinical features. *Cephalalgia.* 2012; 32(12):916-923.
14. Seeberger MD, Kaufmann M, Staender S, Schneider M, Scheidegger D. Repeated dural punctures increase the incidence of postdural puncture headache. *Anesth Analg.* 1996; 82(2):302-305.
15. Amorim JA, Valenca MM. Postdural puncture headache is a risk factor for new postdural puncture headache. *Cephalalgia.* 2008; 28(1):5-8.
16. O'Connor G, Gingrich R, Moffat M. The effect of spinal needle design, size, and penetration angle on dural puncture cerebral spinal fluid loss. *AANA J.* 2007; 75(2):111-116.
17. Silva Lde A, de Carli D, Cangiani LM, Goncalves Filho JB, da Silva IF. Epidural blood patch in Jehovah's Witness: two cases report. *Rev Bras Anesthesiol.* 2003; 53(5):633-639.
18. So Y, Park JM, Lee PM, et al. Epidural Blood Patch for the Treatment of Spontaneous and Iatrogenic Orthostatic Headache. *Pain Physician.* 2016; 19(8):E1115-E1122.
19. Stein MH, Cohen S, Mohiuddin MA, Dombrovskiy V, Lowenwirt I. Prophylactic vs therapeutic blood patch for obstetric patients with accidental dural puncture--a randomised controlled trial. *Anaesthesia.* 2014; 69(4):320-326.
20. Sun S, Huang SQ. Epidural injection of hydroxyethyl starch in the management of post-dural puncture headache: a case series. *Int J Clin Exp Med.* 2015; 8(5):8254-8258.
21. Mehta S RS, Goel N. Postdural puncture headache. *Advances in obstetrics and gynecology (Vol. 3).* Jaypee Brothers Medical Publisher. 2011:p143-p146.