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Case Report

Epidural injection of hydroxyethyl starch in the management of post-dural puncture headache: a case series

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Abstract: Epidural injection of hydroxyethyl starch may be a suitable alternative for treatment of post-dural puncture headache (PDPH) if epidural blood patch is contraindicated. We reported eight consecutive female patients with accidental dural puncture (ADP), among whom prophylactic or therapeutic epidural injection of hydroxyethyl starch was performed. Prophylactic epidural injection of hydroxyethyl starch 20 ml was conducted once a day for two days, without sufentanil supplementation, and mild PDPH took place in three of four patients. Prophylactic epidural injection of hydroxyethyl starch 20 ml combined with sufentanil 5 μg were performed once a day for two days in three patients, and no PDPH happened. Therapeutic epidural injection of hydroxyethyl starch 20 ml combined with sufentanil 5 μg were carried out once a day for 3 days in the patient whom relatively severe PDPH had occurred. Further prospective studies of epidural injection of hydroxyethyl starch in patients with ADP are required to create evidence-based clinical guidelines for safe practice.

Keywords: Post-dural puncture headache, accidental dural puncture, hydroxyethyl starch

Post-dural puncture headache (PDPH) is a severe iatrogenic complication after accidental dural puncture (ADP) [1]. Recent study [2] has indicated that the use of an epidural injection of hydroxyethyl starch may be a suitable alternative for treatment of PDPH if epidural blood patch is contraindicated. Parturients with ADP during labor analgesia are more susceptible to PDPH [3]. Whether epidural injection of hydroxyethyl starch may have favorable effects on parturients with ADP during labor analgesia is not clarified, and whether prophylactic or therapeutic epidural injection of hydroxyethyl starch may yield better results leaves undetermined.

Case reports

We describe eight consecutive female patients with ADP. Among them, case one, two, three, five and six underwent caesarean section under combined spinal and epidural anesthesia, case four underwent unilateral adnexectomy under combined spinal and epidural anesthesia, and case seven and eight had labor analgesia under epidural anesthesia. All patients gave their informed consent before treatment with epidural injection of hydroxyethyl starch and the local ethic commission approved this investigation. Prophylactic epidural injection of hydroxyethyl starch was performed in case one, two, three, four, five, six and seven (**Table 1**), and no other conservative treatment was carried out in all patients.

For case one, two, three and four, prophylactic epidural injection of hydroxyethyl starch 20 ml was conducted once a day for two days, without sufentanil supplementation, and mild PDPH took place in three of them, which lasted no longer than two days (**Table 1**). For case five, six and seven, prophylactic epidural injection of hydroxyethyl starch 20 ml combined with sufentanil 5 μg were performed once a day for two days, and no PDPH happened (**Table 1**). For case eight, therapeutic epidural injection of hydroxyethyl starch 20 ml combined with sufentanil 5 μg were carried out once a day for 3 days, and relatively severe PDPH occurred.

Table 1. Clinical features of seven patients, who received prophylactic epidural injection of hydroxyethyl starch therapy-resistant PDPH after neuraxial block

No	Age (yr)	Height (cm)	Weight (kg)	BMI ($kg/m^{2)}$	Way of delivery	Way of anesthesia	Sufentanil supplementation	PDPH intensity		
								PDPD1	PDPD2	PDPD3
1	39	157	80	40.6	CD	CSEA	No	No	No	No
2	27	165	63	23.1	CD	CSEA	No	Mild	Mild	No
3	34	160	75	29.3	CD	CSEA	No	No	Mild	No
4	46	156	56	23.0		CSEA	No	No	Mild	Mild
5	27	167	70	25.1	CD	CSEA	Yes	No	No	No
6	30	162	71	27.1	CD	CSEA	Yes	No	No	No
7	29	160	62	24.2	VD	EDA	Yes	No	No	No

VD, vaginal delivery; CD, caesarean delivery; CSEA, combined spinal and epidural anesthesia; EDA, epidural anesthesia; PDPH, post-dural puncture headache; PDPD, post-dural puncture day.

Case 7

A healthy 29-year-old G_1P_0 woman was admitted in spontaneous labour at $40^1/_7$ weeks of gestation. Labor analgesia was requested by the parturient at dilatation of cervix of 2 cm. There was no contraindication to epidural analgesia. In the lateral position at $L_{2\text{-}3}$, with a 16-gauge Tuohy needle (SIMS Portex, Hythe, Kent, United Kingdom), spinal dura mater was penetrated during puncture, retreat to epidural space was done, and the epidural space was identified using a loss-of-resistance to saline technique. An epidural multihole catheter was advanced uneventfully 4 cm into the epidural space, a test dose of 1% lidocaine 5 ml was administered, and a loading dose of 0.1% ropivacaine plus 0.5 $\mu g \cdot ml^{-1}$ sufentanil 8 ml were administered after no sign of spinal anesthesia 5 min later. Analgesia pump was connected, patient-controlled epidural analgesia (PCEA) was conducted, and it was uneventful. The upper sensory block level to cold was T_{10} with blood pressure 114/72 mmHg and heart rate 93 beats/min. The first stage of labor lasted for 11.5 h, and the second stage of labor lasted for 70 min. There was no instrumental delivery.

After entering the second stage of labor, epidural analgesia pump was switched off, and epidural administration of hydroxyethyl starch 20 mL (Voluven®, Fresenius Kabi Laboratories, Beijing, China) plus sufentanil 5 μg (batch: 100608, Yichang Humanwell Pharmaceutical Co., Ltd) was done. It was uneventful, with blood pressure 112/72 mmHg and heart rate 84 beats/min.

The patient did off-bed activity on the first day after delivery, and there was no complaint. Epidural administration of hydroxyethyl starch 20 mL plus sufentanil 5 μg was performed, and it was uneventful, with blood pressure 108/74 mmHg and heart rate 82 beats/min.

Off-bed activity was successfully achieved on the second, third and fourth day after delivery, and there was no complaint. The patient was discharged home on fourth day after delivery. Telephone follow-up three weeks later confirmed that PDPH had not occurred and there were no neurologic sequelae.

Case 8

A healthy 31-year-old G_2P_0 woman was admitted in spontaneous labour at $40^5/_7$ weeks of gestation. Labor analgesia was requested by the parturient at dilatation of cervix of 2 cm. There was no contraindication to epidural analgesia. In the lateral position at $L_{2\text{-}3}$, with a 16-gauge Tuohy needle (SIMS Portex, Hythe, Kent, United Kingdom), the first attempt of puncture failed due to greater resistance, and the second attempt succeeded after direction adjustment. The epidural space was identified using a loss-of-resistance to saline technique. An epidural multihole catheter was advanced uneventfully 4 cm into the epidural space, a test dose of 1% lidocaine 5 ml was administered, and a loading dose of 0.1% ropivacaine plus 0.5 $\mu g \cdot ml^{-1}$ sufentanil 8 ml were administered after no sign of spinal anesthesia 5 min later. Analgesia pump was connected, patient-controlled epidural analgesia (PCEA) was conducted, and the parturient complained serious foot numbness about 30 min later, with blood pressure 122/78 mmHg and heart rate 88 beats/min. The sensory block level to cold was

T_{10}. No cerebrospinal fluid was obtained at epidural back-extraction, analgesia pump was switched off, and foot numbness relieved about 30 min later, with blood pressure 126/74 mmHg and heart rate 91 beats/min. No such symptoms happened after switching on the analgesia pump. The first stage of labor lasted for 8.5 h, and the second stage of labor lasted for 80 min. There was no instrumental delivery.

When the patient got off the bed for the second time at 9 AM on the first day after delivery, she complained of a temporal headache and neck ache that disappeared when lying supine, which emitted to both arms. Neurological examination was normal, with no nuchal rigidity, mental status change or fever, and the patient was seriously requested to lay on bed. After written informed consent was obtained, the patient was transferred to the operation room at 16 PM for L_{3-4} epidural catheterization, and an epidural injection of hydroxyethyl starch 20 mL (Voluven®, Fresenius Kabi Laboratories, Beijing, China) +sufentanil 5 μg (batch: 100608, Yichang Humanwell Pharmaceutical Co., Ltd) were offered. Bilateral thigh skin temperature increase and numbness occurred about 2 min after medication, and the patient was drowsy, with blood pressure 110/74 mmHg and heart rate 84 beats/min. The symptoms completely disappeared about 2 h later, and the patient returned to the ward.

Epidural administration of hydroxyethyl starch 20 ml plus sufentanil 5 μg was performed on the second day after delivery, and thigh skin temperature increase occurred about 2 min after medication, with no numbness and drowsiness, blood pressure 114/74 mmHg and heart rate 82 beats/min, and the symptoms completely disappeared about 0.5 h later.

Epidural administration of hydroxyethyl starch 20 ml plus sufentanil 5 μg was also conducted on the third day after delivery, and there was no thigh skin temperature increase, numbness and drowsiness, with blood pressure 122/80 mmHg and heart rate 78 beats/min, then the epidural catheter was removed.

The patient laid on bed on the fourth day and fifth day after delivery, and tried to sit on bed on the sixth day, still with mild head tension. The patient did off-bed activity on the seventh day after delivery, and it was uneventful. The patient was discharged home on eighth day after delivery. Telephone follow-up three weeks later confirmed that PDPH had not recurred and there were no neurologic sequelae.

Discussion

Younger age, female and spontaneous delivery are high risks of PDPH [4], therefore, parturients are susceptible to PDPH. There has been fewer studies recently on epidural injection of hydroxyethyl starch in prevention and treatment of PDPH. O. Vassal et al [2] reported two cases of PDPH successfully treated by epidural hydroxyethyl starch, and one of the cases received hydroxyethyl starch injection directly after epidural puncture, without epidural catheterization. In our regimen, epidural catheterization was performed for prophylactic or therapeutic epidural injection of hydroxyethyl starch, which reduced the injury of multiple puncture and chance of ADP recurrence. In our study, mild PDPH occurred only in 3 cases among 7 cases undergoing prophylactic epidural injection of hydroxyethyl starch, while one case receiving therapeutic epidural injection of hydroxyethyl starch experienced severe PDPH, which indicated prophylactic management might bring about better results. However, epidural injection of hydroxyethyl starch should be conducted after residual never block withdrawl to avoid the occurrence of total spinal anesthesia [5].

The mechanisms of epidural injection of hydroxyethyl starch in prevention or treatment of PDPH are undetermined. Since epidural coagulation may not take place for hydroxyethyl starch, its leaking stoppage function is mild. Some studies have revealed that epidural injection of normal saline or blood patch may reduce the chance of PDPH by increasing cerebrospinal fluid pressure [6], and others hold the opinion that blood patch stimulates spinal dura mater to produce inflammatory reaction and blocks puncture hole, which may be one of the mechanisms of blood patch in treatment of PDPH [7]. Therefore, we propose that cerebrospinal fluid pressure increase and inflammatory reaction produced by spinal dura mater stimulation to block puncture hole after epidural injection of hydroxyethyl starch may be the

main mechanisms of prevention and treatment of PDPH.

Some studies [8] indicated that epidural injection of morphine could reduce the incidence of PDPH. In our study, 3 parturients with mild PDPH did not receive sufentanil for prophylactic purpose, while PDPH did not occur in another 3 parturients undergoing prophylactic management with sufentanil, which indicated that epidural application of sufentanil might have prophylactic effect on PDPH. There are debates on the safety of intrathecal administration of opioids in prevention and treatment of PDPH. The major concern lies on the possible respiratory suppression after entrance of opioids into subarachnoid space from spinal dura mater hole. In our study, epidural administration of sufentanil was performed in case 5, 6, 7 and 8. In case 8, bilateral thigh skin temperature increase and numbness occurred about 2 min after medication, and the patient was drowsy, which was possibly caused by the entrance of sufentanil into subarachnoid space from larger spinal dura mater hole. However, due to the liposolubility characteristics, the dispersion of sufentanil in subarachnoid space is more limited than the water-soluble drugs. In our study, the dose of sufentanil (5 μg) for epidural administration was also safe for subarachnoid space application, so no adverse effects such as respiratory suppression occurred.

Blood patch is currently a golden standard for treatment of PDPH. The white cell count and neutrophils count may sometimes increase in parturients, therefore, the possibility of maternal infection in perineum should be excluded before blood patch treatment [9]. The reported successful rate of first-attempt blood patch ranged between 33% and 64% [10], and a second-attempt or third-attempt blood patch may be required in some patients for the successful treatment of PDPH. If epidural catheter is detained for blood patch treatment, the blood clot may block the catheter, and the catheter may be out of use for a second-attempt blood patch. Therefore, it is not suitable to detain epidural catheter in blood patch treatment. In case of larger spinal dura mater hole, the blood may enter into subarachnoid space and cause subarachnoid edema and arachnoiditis [11]. So we consider it is prudent for the parturients to receive blood patch treatment, and epidural injection of hydroxyethyl starch may serve as a substitute.

We recommend detaining epidural catheter in prevention and treatment of PDPH in parturients. After the retreat of residual nervous block, epidural administration of hydroxyethyl starch 20 ml + sufentanil 5 μg is performed, and is supplemented 24 h later before epidural catheter withdrawl. If the symptoms deteriarate 48 h later, epidural blood patch treatment can be considered. Besides effectiveness, there are some other advantages of our regimen: prophylactic epidural catheter detaining is the basic procedure of anesthesia for caesarean section and labor analgesia, which does not require additional procedure; the detained catheter may facilitate multiple epidural injection of hydroxyethyl starch, and avoid the injury from multiple epidural puncture and the recurrence of ADP, which increases the acceptance of patients; in case of contraindications of blood patch such as infection and leukemia, hydroxyethyl starch may substitute blood and ensure the continuous use of epidural catheter.

Disclosure of conflict of interest

None.

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References

[1] Turnbull DK, Shepherd DB. Post-dural puncture headache: pathogenesis, prevention and treatment. Br J Anaesth 2003; 91: 718-729.

[2] Vassal O, Baud MC, Bolandard F, Bonnin M, Vielle E, Bazin JE, Chassard D. Epidural injection of hydroxyethyl starch in the management of postdural puncture headache. Int J Obstet Anesth 2013; 22: 153-155.

[3] Russell IF. A prospective controlled study of continuous spinal analgesia versus repeat epidural analgesia after accidental dural puncture in labour. Int J Obstet Anesth 2012; 21: 7-16.

[4] Angle P, Thompson D, Halpern S, Wilson DB. Second stage pushing correlates with headache after unintentional dural puncture in parturients. Can J Anaesth 1999; 46: 861-866.

[5] Leivers D. Total spinal anesthesia following early prophylactic epidural blood patch. Anesthesiology 1990; 73: 1287-1289.

[6] Kroin JS, Nagalla SK, Buvanendran A, McCarthy RJ, Tuman KJ, Ivankovich AD. The mechanisms of intracranial pressure modulation by epidural blood and other injectates in a postdural puncture rat model. Anesth Analg 2002; 95: 423-429.
[7] Djurhuus H, Rasmussen M, Jensen EH. Epidural blood patch illustrated by CT-epidurography. Acta Anaesthesiol Scand 1995; 39: 613-617.
[8] Al-metwalli RR. Epidural morphine injections for prevention of post dural puncturehead-ache. Anaesthesia 2008; 63: 847-850.
[9] Allen DL, Berenguer JV, White JB. A potential complication of early blood patching following inadvertent dural puncture. Int J Obstet Anesth 1993; 2: 202-203.
[10] Williams EJ, Beaulieu P, Fawcett WJ, Jenkins JG. Efficacy of epidural blood patch in the obstetric population. Int J Obstet Anesth 1999; 8: 105-109.
[11] Aldrete JA, Brown TL. Intrathecal hematoma and arachnoiditis after prophylactic blood patch through a catheter. Anesth Analg 1997; 84: 233-234.