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CASE SERIES

Epidural Hydroxyethyl Starch in Treatment of Post Epidural Puncture Headache: A Case Series and Literature Reviews

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Background: Post-dural puncture headache (PDPH) is a common complication of obstetric anesthesia. There are still no convenient and effective methods to control the PDPH.

Case Presentation: Three cases of parturients with accidental dural puncture who suffered post-dural puncture headache (PDPH) after labor analgesia or cesarean section. They were treated with epidural hydroxyethyl starch (HES) through an epidural catheter and achieved well therapeutic effect.

Conclusion: Treatment of PDPH by epidural HES is a promising method that may benefit the parturient and doctor.

Keywords: post-dural puncture headache, PDPH, hydroxyethyl starch, epidural pump, parturient

Introduction

Post-dural puncture headache (PDPH) is a common complication of obstetric anesthesia. In analgesic labor, an epidural catheter must be inserted into the epidural space. With increasing demand for analgesic labor, the incidence of accidental dural tap is increasing. Similarly, cesarean section requires epidural anesthesia or combined spinal epidural anesthesia, and accidental dural tap can occur as well. There are many factors involved in accidental dural tap, including epidural cavity adhesion, difficult puncture, inexperienced resident, obese maternity, maternal non-cooperation, previous labor analgesia, and so on.

Case Presentation

Case 1. A parturient (age 28 years, weight 71 kg, height 160 cm) endured labor analgesia in March 2023. Epidural puncture was performed at the L3-L4 space by using of a 16G Tuohy needle. She was confirmed to have an accidental dural tap. Clear cerebral spinal fluid (CSF) was seen pouring out from the needle. The Tuohy needle was retracted slightly, and an epidural catheter was inserted into the same epidural space. The labor analgesia was successfully completed by use of an electronic infusion pump to deliver 0.08% ropivacaine and sufentanil 0.5 μg/mL. She developed severe headache of the forehead, with blurred vision after laboring. Her epidural catheter was still in place after labor. Balanced 6% Hydroxyethyl Starch 130/0.4 (Volulyte, Fresenius Kabi, Beijing, China) 15 mL was injected slowly into the epidural space through the epidural catheter over 15 minutes (5 mL at a time at 5-minute intervals). The patient felt much better and the dizziness disappeared immediately. A patient-controlled electronic infusion pump was connected to the epidural catheter. Pure HES 100mL was filled into the electronic infusion pump. The infusion rate was 4 mL/h, with a bolus 4 mL and a lock-out time 15 min. The patient was allowed to sit up and walk to pass urine 6 hours after the first dose of HES. She was then able to walk freely without any headache or dizziness. In case headache occurred when

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walking, she was told to lie down on the bed and then press the infusion pump button for one additional bolus dose of HES. She was allowed to sit up again and walk one hour later. In fact, she did not press the bolus button for an extra dose. Her epidural HES continuous infusion was stopped at 10 hours, while the epidural catheter was left in place in case a bolus dose of HES was needed after the initial infusion. The epidural catheter was removed 24 hours after the loading dose, without any additional bolus required. She did not experience any headache after the first 15-mL dose of HES. The total dose of HES injected into the epidural space was 55 mL.

Case 2: This pregnant lady (age 33 years, weight 71 kg, height 160 cm) was planned for elective cesarean section under combined spinal–epidural anesthesia in March 2023. When the 16G Tuohy epidural needle was inserted, the doctor convinced a L3-L4 dural tap. About 0.5% bupivacaine 1.7 mL was injected into the subarachnoid space through a 25G Whitacre spinal needle. The epidural catheter was placed in the epidural space. The cesarean section was completed successfully. The epidural catheter was kept in place. The patient developed headache 2 hours after the surgery. HES 130/0.4 15 mL was injected slowly into the epidural space. A patient-controlled infusion pump containing 6% HES 130/0.4 was connected to the epidural catheter. It was set 0 mL/hour, a 4-mL bolus, and a lockout time 15 min. The patient sat up and walked freely to pass urine 2 hours after the first dose of epidural HES. She was given the same instructions as the above case if headache reoccurred. Actually, she did not press the pump for any further dose. Her headache was relieved after the first loading dose of 15 mL, without reoccurrence. Twenty-four hours after the first loading dose, the epidural catheter was removed. The total dose of HES injected into the epidural space was 15 mL.

Case 3: This pregnant women (age 31, weight 59kg, height 157cm) was planned to receive epidural labor analgesia in September 2023. When the 16G Tuohy epidural needle was inserted at the L3-L4 space, a dural tap was confirmed. The doctor inserted the epidural catheter into the epidural space. The labor analgesia protocol was the same as the first case. The parturient had a satisfactory labor analgesia. For treatment of her PDPH, the catheter was kept in place. She suffered headache while walking around the bed 8 hours later. HES 130/0.4 15 mL was injected into the epidural space. A patient-controlled pump containing HES was connected to the epidural catheter. It was set 0 mL/hour, with a 4-mL bolus as required. She pressed the pump once for a further dose 14 hours after the dural tap while walking around the bed again. Her headache disappeared immediately after the additional bolus of HES. Two hours later, she sat up and no headache occurred again. No extra dose of epidural HES was needed, and the epidural catheter was removed 48h later. The total dose of epidural HES was 19mL.

The follow-up of all the cases above was conducted one week after discharge through telephone, and no nephrotoxicity, bleeding, and organ dysfunction were feed back. And there were no more symptoms such as headache and dizziness.

Discussion

The incidence of post-dural puncture headache (PDPH) in parturients is higher than that in other populations, and the incidence varies greatly, ranging from <2% to 40% depending on surgical and patient factors.[1] PDPH during analgesic labor often brings obvious troubles to the parturient. Timely and effective treatment may reduce or even avoid physical and mental harm to the parturient, helping them to get through the perinatal period healthily.[2]

In all our reported cases, typical headache occurred after accidental dural puncture by a 16G Tuohy needle. One woman's headache was accompanied by dizziness, blurred vision, and hearing loss. The International Headache Association states that PDPH is any headache that occurs within 5 days of dural puncture, worsening within 15 minutes of assuming an upright position and disappearing within 15 minutes in a supine position. Headaches usually occur in the frontal and occipital areas. They are often accompanied by neck stiffness and subjective hearing symptoms. They can resolve without treatment within 2 weeks or be treated by plugging the leak with an epidural blood patch.[3]

Dural puncture may lead to excessive leakage of cerebrospinal fluid and reduced cerebrospinal fluid pressure. Headache may be associated with the decrease in cerebrospinal fluid pressure and stretching of intracranial structures in the upright position, leading to typical headaches. Another assumption is that the loss of cerebrospinal fluid may produce compensatory vasodilation. Dilated veins are one of the causes of headache.

At present, supportive treatments such as bed rest, intravenous hydration treatment, pharmacological treatment, and nerve block are the main treatments for PDPH. Studies have demonstrated that an epidural blood patch is an effective

treatment for severe PDPH.[4] Treatment of PDPH using epidural HES patch has also been reported.[5,6] However, randomized controlled clinical studies of epidural HES patches with sufficient evidence are lacking.

Yu J's research found that an epidural crystal–colloid solution patch may be an effective measure to prevent headache after cesarean section.[5] In another case report, PDPH was managed successfully by injecting a colloid solution (gelatin) into the epidural space.[6] In epidural liquid filling treatment, gelatin, dextran 40, and HES solutions have been explored. It was suggested that in mild cases of PDPH, conservative treatment including bed rest and oral caffeine can be used. In moderate-to-severe PDPH, epidural blood patches remain the major treatment.[7]

All the three cases we reported, the patients' symptoms were significantly relieved after the loading dose of epidural HES, and only one needed an additional epidural dose for treating postural headache. The patients were able to pass urine early, avoiding the possibility of urinary tract infection caused by long-term reservation of a urinary tube. Avoiding long-term bed rest is undoubtedly beneficial to maternal recovery and decreases the possibility of deep vein thrombosis. In all cases, the duration of epidural catheter was left in place for 24–48 hours, and the epidural dose ranged from 15mL to 55mL of HES in the first 24 hours. The length of hospital stay was not affected, and no symptom such as headache occurred again in follow-up. The maternal survey during hospitalization was satisfactory, and there was no impact on daily life during hospitalization, including breast feeding, activities, urination, diet, and sleep.

Compared with epidural blood patch, HES was injected into the epidural space through the epidural catheter in our cases. The epidural catheter is retained after analgesic labor or cesarean section. This method has the following advantages: first, it is not necessary to perform epidural puncture again, so as to avoid the possibility of re-puncture injury or unexpected extra dural tap, and avoiding injuries of drawing blood. Second, the colloid solution can be injected through an indwelling epidural catheter without causing catheter blockage. The colloid solution can be continuously infused or injected repeatedly and individually. Third, the most attractive point is applying the patient-controlled epidural infusion pump, which is often used for postoperative analgesia. In these cases, the pump was innovatively applied to PDPH treatment.

All the patients were given the loading dose, we chose 15 mL of epidural HES on the basis of the usual epidural analgesia induction volume. The volume of colloid we used was smaller than the volume (20–30 mL) of epidural blood patch mentioned in the previous articles.[8–10] Since a smaller dose of colloid might be safer by not increasing the pressure in the epidural space too much. Excessive pressure in the epidural space risks complications such as compression of the subarachnoid space, radicular pain, and lower limb discomfort. Whether continuous infusion is needed remains to be explored.

Epidural saline infusion is another reported therapy, but its effect is not well determined. Normal saline might be absorbed by tissue quickly in the epidural space. In comparison, colloids such as HES cannot be easily absorbed, and this might prolong the increased pressure effect on the disrupted dural, which probably accelerate closure of the dural perforation.

In summary, we have reported three cases of PDPH that were successfully treated with epidural HES. Treatment of PDPH by epidural HES is a promising method that may benefit the parturient and doctor. Since the number of observed cases is limited, more studies are needed to confirm the effectiveness and safety of epidural HES patching. Nevertheless, more studies are needed to better define the role of this technique.

Ethics and Consent Statements

Guangxi Hospital Division Of The First Affiliated Hospital, Sun Yat-Sen University, Ethical Review Committee Approval Number: KY-LW-2024(002). Written informed consent was obtained from the patients for publication of this case report.

Disclosure

The authors report no conflicts of interest in this work.

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