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A comprehensive analysis of continuous epidural analgesia's effect on labor and neonates in maternal hypertensive disorder patients

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ABSTRACT

Background: Maternal hypertensive disorder is one of the most common and severe medical complications during pregnancy. Epidural analgesia administration is widely used during labor process.
Aim: To evaluate the potential advantage or disadvantage of continuous epidural analgesia's on labor and neonates for maternal hypertensive disorder patients comprehensively.
Methods: We have retrospectively analyzed 232 patients who diagnosed as maternal hypertensive disorder in our hospital since 2015. Among which, 126 patients including 28 cases of severe preeclampsia were administrated with continuous epidural analgesia (Analgesia group), the other 106 patients were untreated (Control group). We have compared the maternal age, body weight, gestational weeks, period for the first and second labor stage; the incidence of eclampsia, natural labor, cesarean section, forceps delivery and postpartum hemorrhage between these two groups respectively; furthermore, we recorded patients who received oxytocin and antihypertensive treatment during the delivery progress as well as evaluated the neonate body weight, Apgar score and performed umbilical cord blood gas analysis.
Results: Continuous epidural analgesia does not affect the first and second labor stage period
Results: ($p = 0.36$), However, there is a significantly higher demand for oxytocin treatment (36.5% Vs 19.8%, $p < 0.01$) and a significantly lower requirement for antihypertensive treatment (22.2% Vs 81.1%, $p < 0.001$) in analgesia group compared to control group.
Results: We also notice that the natural delivery ratio in analgesia group is higher than control group and most importantly, continuous epidural analgesia can increase 1 min Apgar score and has no other effect on neonates' body weight, umbilical cord blood gas parameters, 5 min and 10 min Apgar score.
Conclusions: Our result based on a large cohort comprehensive analysis indicates that continuous epidural analgesia can benefit both maternal hypertensive disorder patients and neonates without any side effect.

1. Introduction

Maternal hypertensive disorder is a special disease during pregnancy, which occurred about 10% of pregnancies globally [1], and it is one of the most serious complications during pregnancy [2]. The patients usually exhibit high blood pressure and proteinuria, which normally disappear after delivery [3]. Clinically, the routine therapy includes antispasmodic, antihypertensive and some other supportive treatment, or in some scenario, terminating the pregnancy at the right time [3]. In western countries, the major complications result from maternal hypertensive disorder are hemolysis, elevated liver enzymes, low platelet count (HELLP syndrome) and Disseminated intravascular coagulation (DIC) [4]; cardiovascular complications and cerebrovascular accidents are rarely reported; whereas in china, it is documented that maternal hypertensive disorder usually induces severe complications such as cerebrovascular accident, heart failure, acute renal failure, HELLP syndrome and pulmonary edema [5].

Many studies have confirmed that continuous epidural anesthesia administration is a safe and efficient way for labor analgesia and can benefit both pregnant women and neonate [6,7]. This approach allows the analgesic to release plane and steady, reduces the motor block and the occurrence of hypotension. Furthermore, patients can adjust dosage and frequency for the administration themselves according to their own demand, therefore the administration is more personalized, and the outcome is much better with fewer side effects.

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The basic pathological character for maternal hypertensive disorder is systemic small artery spasm [8]. The stress response induced by the pain during labor process can aggregate patients' condition, or even cause some severe complications such as eclampsia [9]. For pregnancies with such symptoms, obstetric doctors are prone to choose cesarean section in order to reduce the risk for the delivery. Recently, some studies have indicated that labor analgesia can ameliorate the stress response and control blood pressure caused by the pain [10]. Effective labor analgesia can increase the blood supply of the uterus and placenta as well as reduce the occurrence of fetal distress in uterus. However, the advantage or disadvantage of epidural labor analgesia for maternal hypertensive disorder patients based on a large cohort investigation is still unclear. Here, we retrospectively analyzed 232 patients who diagnosed as maternal hypertensive disorder (including 28 cases of severe preeclampsia) in Beijing Obstetrics and Gynecology Hospital since 2015 and evaluated the therapeutic outcome of epidural labor analgesia.

2. Material and methods

2.1. Patients

We collected 232 patients who diagnosed as maternal hypertensive disorder (including 28 cases of severe preeclampsia) in our hospital since 2015. The patients are ranging from 20 to 35 years old who are pregnant for the first time, single embryo, and the gestational weeks are between 36 and 41 weeks. 126 patients were given continuous epidural labor analgesia, including 28 cases of severe preeclampsia; the other 106 patients were untreated as controls.

The diagnostic criteria for maternal hypertensive disorder complicating pregnancy are described as follows:

Gestational hypertension is defined as that hypertension is only detected for the first time during pregnancy, systolic blood pressure $\geqslant$140 mmHg and(or) diastolic blood pressure $\geqslant$90 mmHg, urine protein is negative, the symptoms are disappeared and patients are back to normal within 12 weeks after delivery.

Severe preeclampsia is defined as: (1) blood pressure is persistently rising: systolic blood pressure $\geqslant$160 mmHg and (or) diastolic blood pressure $\geqslant$110 mmHg; (2) persistent headache, visual disturbances or other central nervous system abnormalities; (3) persistent upper abdominal pain and liver subcapsular hematoma or symptoms of liver rupture; (4) liver enzyme abnormalities: increased serum alanine aminotransferase (ALT) and aspartate aminotransferase (AST) levels; (5) impaired renal function: urine protein >2.0 g/24 h; oliguria (24 h urine output <400 ml, or hourly urine output <17 ml), or serum creatinine >106 μmol/L; (6) hypoalbuminemia with ascites, pleural or pericardial effusion; (7) blood abnormalities: sustained decreased platelet count ($<100 \times 10^9$/L); microvascular hemolysis (anemia, jaundice, or increased blood lactate dehydrogenase (LDH) levels); (8) heart failure; (9) pulmonary edema; (10) fetal growth restriction or oligohydramnios, fetal death, early placenta abruption and so on.

Mild preeclampsia is defined as: systolic blood pressure $\geqslant$140 mmHg and (or) diastolic blood pressure $\geqslant$90 mmHg after 20 weeks of gestation, and accompanied with any of the following symptoms: proteinuria $\geqslant$0.3 g/24 h, or urine protein/creatinine $\geqslant$0.3, or random urine protein positive (when proteinuria determination is not applicable); when proteinuria is negative but associated with any of the following organ or system dysfunction: such as heart, lung, liver, kidney, or blood system, digestive system, nervous system, or placenta – fetus abnormality.

2.2. Continuous epidermal analgesia administration

Patients in the analgesia group requested analgesia after entering the first labor stage voluntarily, when fetal heart rate were normal, patients were informed and consent agreements were signed with the anesthesiologist, continuous epidural anesthesia was administrated at lumbar 2–3 or 3–4 gap by puncture and cephalic epidural catheter 3 cm, 5 ml of 2 mg/ml ropivacaine was given first and patients were monitored for 5 min, followed with 10–15 ml mixture of 1 mg/ml ropivacaine and 0.5 mg/ml sufentanil, 30 min later, epidural analgesia pump was connected to the epidural catheter, the analgesia mixture in the pump was 1 mg/ml ropivacaine and 0.5 μg/ml sufentanil, the baseline infusion dose was 5 ml/h, the PCA was 5 ml every time and fixed for 15 min. Patients were encouraged to rest or move appropriately to facilitate fetal loss and labor process, when the analgesic effect diminished, patients could adjust epidural administration by controlling micro-pump. When the cervix was almost fully open, the analgesia administration was terminated.

For the control group: patients refused any continuous epidural labor analgesia during delivery progress.

We documented maternal patients' age, body weight and gestational weeks; the period for the first and second labor stage; the incidence of eclampsia, natural labor, cesarean section, forceps delivery, postpartum hemorrhage; recorded the usage of oxytocin and antihypertensive during the delivery progress; recorded the neonate weight, Apgar score and performed the umbilical cord blood gas analysis. Postpartum hemorrhage was defined as vaginal bleeding over 500 ml after delivery in 24 h.

3. Statistics

Data was shown as mean ± SEM and analyzed using unpaired *t*-test. For categorical data like adverse events, Chi-square test was applied. In this study, $P < 0.05$ was accepted to be statistically significant.

4. Results

We had compared patients' age, body weight, gestational weeks between analgesia and control group, but didn't detect any difference (Fig. 1), which indicated that our study was unbiased.

4.1. No difference was detected for the period of first and second labor stage between analgesia and control group

We had compared the periods for the first and second labor stage between control and analgesia group respectively, and we noticed that both first and second labor stage were slightly prolonged in analgesia group, but there was no significant difference detected (Fig. 2).

4.2. Continuous epidural analgesia treated maternal hypertensive disorder patients required more oxytocin but much less antihypertensive treatment

21 patients (19.8%) in control group were treated with oxytocin, while 46 patients (36.5%) in analgesia group required oxytocin treatment, in contrast, 86 patients (81.1%) in control group compared to 28 patients (22.2%) in analgesia group required antihypertensive treatment (Fig. 3), this result suggested that patients treated with continuous epidermal analgesia usually need treatments to induce labor but much less measures to control blood pressure.