Case report: use of ketamine in combination with epidural anesthesia for cesarean section in the patient with severe congenital hypothyroidism

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Keywords: Congenital hypothyroidism, epidural anesthesia, ketamine

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Abstract

Background: Severe maternal congenital hypothyroidism with term pregnancy is extremely rare. It is really challenging to make an optimal anesthesia management strategy that is both less stressful for the anesthesiologist and safer for both the mother and her infant.

Case presentation: A case is presented for a 22-year-old pregnant woman with severe congenital hypothyroidism, who was undergone successful epidural anesthesia for an elective cesarean section (CS). She was weight 28 Kg and measured 112 cm in height at term. Spontaneous ventilation was maintained throughout the case while ketamine was used for attenuating the activity of sympathetic system and alleviating the pain and anxiety of the patient. Both the parturient and neonate were well and discharged 4 days later.

Conclusion: it is rare that natural conception succeeds on this severe congenital hypothyroid woman. In high-risk patients with severe congenital hypothyroidism, we recommend strongly that epidural anesthesia may be an optimal and safe technique for both the mother and her infant.

Keywords: Congenital hypothyroidism, epidural anesthesia, ketamine

Background

Congenital hypothyroidism has an incidence of between 1 in 2500 and 1 in 4000 livebirths and there are some indications that the incidence is still rising ^[1]. According to the test of thyroid stimulating hormone (TSH), most cases nowadays can be found in the early stage and can be treated by replacement therapy in order to achieve neonatal normal development outcomes. Maternal hypothyroidism is an infrequent phenomenon with approximately 0.3%-0.5% prevalence ^[2], most of which exhibits as subclinical status. Maternal hypothyroidism is associated with a variety of pregnancy complications, including an increased risk of miscarriage ^[3], placental abruption, postpartum hemorrhage and preterm delivery ^[4]. The hypothyroidism could also affect the cardiovascular system, neuromuscular function, abnormal coagulation, etc. Severe maternal congenital hypothyroidism with term pregnancy is extremely rare. We share our experience in the anesthetic management of cesarean section at term in a patient with severe maternal Thyroid Deficiency.

Case Presentation

A 22- year-old woman (G₁P₀) with pregnancy was first admitted in hospital at the gestation of 28 weeks due to dizziness, weakness and tachycardia. The laboratory test shows that the hemoglobin was 43g/L. All symptoms were alleviated when hemoglobin was rised up to 77g/L by the infusion of erythrocyte suspension. She had typical clinical presentations, including growth retardation, slowed mental processing, paraesthesia. She had no any laboratory tests and treatments.

At the gestation of 40 weeks and 2 days, she was admitted in hospital again for an elective CS. She was weight 28 Kg and measured 112 cm in height. She had a normal sized thyroid gland and no bruit. Pretibial edema was missed. The obstetric examinations are as follows: the height of uterus fundus: 33 cm, the abdominal circumference: 78 cm, the interspinous diameter: 20.5 cm, the intercrestal diameter: 22 cm, the external conjugate diameter: 14.5 cm, and the ischial intertuberal diameter: 6.5 cm, respectively. The femur length of the fetus is 6.7 cm with the biparietal diameter of 8.9 cm. She had hemoglobin of 102 g/L, with haematocrit of 30.9%. The albumin 29.7 g/L is lower than the normal value with the abnormal aspartate aminotransferase (AST) and aminoleucine transferase (ALT). The electrolytes and kidney functions were normal. The serum thyroxine (total T_4) was 12.20 nmol/L (normal range 58.1-173); the triiodothyronine (total T_3) was 0.51 nmol/L (normal range 0.92-3.7); the free T_4 (FT $_4$) was 3.75 pmol/L (normal range 11.5-22.7); the free T_3 (FT $_3$) was 1.36 pmol/L (normal range 3.5-6.5), and the TSH was larger than 150.000 mIU/L (normal range 0.55-4.78). However, these are altogether with the normal thyroglobulin autoantibody (TGAb) of 39.0 IU/ml and thyroid peroxidase antibody of 49.0 IU/ml (TPOAb).

In the operating room, standard ASA monitors were attached to the patient, and Supplemental oxygen was administrated by a face mask at the rate of 3 L/min. After anatomical landmarks were identified and appropriate site preparation, the epidural catheter was inserted into the L1-L2 space. 3 ml lidocaine 1.5% was given into the epidural space immediately after the patient was placed spine position with thick pillows under her head. No local anesthetic was ensured to be injected into the blood by carefully observing the vital signs and the reaction of the patient. Then another 5ml lidocaine was injected into the epidural space in divided dose. Pinprick was used to evaluate the sensory block, and motor block was presented in 15 minutes after the last injection. The final block segment was under T $_7$. Before the surgery, 1mg/Kg ketamine was given intravenously. Spontaneous ventilation was maintained and SpO $_2$ was kept at 99% throughout the surgery. The blood pressure was 98-115/60-75 mmHg, and heart rate was 85-103 beat per minutes, respectively. The male neonate was 2650g weight, 45 cm height, and has an Apgar score of 9-10-10 at 1, 5 and 10 min, respectively. Patient and the baby were well and discharged 5 days later.

Discussion And Conclusions

Hypothyroidism may be an elusive clinical entity because of the variety of end-organ effects and wide range of disease severity. It is potentially serious in young women because of the lower fertility rate than euthyroid women and neuroendocrine and ovarian dysfunction^[5, 6]. Normal thyroid gland function is critical for pregnancy^[7]. Hypothyroidism affects women, either before, during, or directly after pregnancy, and Early diagnosis and treatment may optimize the condition of both the mother and fetus^[8]. Once the diagnosis was confirmed, treatment is straightforward, and the patient's prognosis is excellent. However, some hypothyroidism cases were often clinically overlooked at the early stage of pregnancy, and accompanied by a variety of pregnancy complications. Because of these complications, the patient need to be examined, and thus hypothyroidism is easy to detect. Severe maternal untreated congenital hypothyroidism with term pregnancy is extremely rare. In our case, she was weigh only 28 Kg and was

112 cm in height at term. She had no any laboratory tests and treatments before admission in our hospital. The neonates have no obvious features of hypothyroidism at birth. We speculated that there may be a transfer of thyroxine(T_4) from mother to fetus at birth. To determine, neonate need to detect the thyroid hormone in the serum of the baby in the first few days of life. We also recommend screening for the baby, but his father firmly refused. Then we didn't know whether the neonate's condition progressively deteriorates in the following weeks after discharged. But early screening, diagnosis and treatment of thyroid hormone deficiency was crucial for high-risk baby whose mother suffered from severe hypothyroidism. Therefore, we suggest that when possible, primary thyrotropin or thyroxine (T_4) testing, the mainstay of newborn screening, should be performed between 2 and 5 days of life.

The clinical manifestation of hypothyroidism refers to not only neuroendocrine and reproductive system, but also cardiovascular system, neuromuscular function, and hematological system. In cardiovascular system, severe untreated hypothyroidism can lead to bradycardia, increased systemic vascular resistance, and decreased cardiac output^[9], obstructive sleep apnea^[10], Both systolic and diastolic myocardial functions are impaired^[11], which occasionally causes congestive heart failure. In neuroendocrine system, a familiar set of symptoms and signs have been associated with depression, psychosis, seizures, and even coma. A basic question about the pregnancy woman who subsequently have severe hypothyroidism is what is the optimal anesthetic management strategy. No prospective randomized studies have conducted to compare the safety or efficacy among various anesthetic techniques in pregnant or nonpregnant hypothyroid patients. Considering the minimization of the anesthesia side effect for our patient with severe maternal thyroid deficiency, we thought epidural anesthesia may be the optimal method. After carefully checking the history, physical examination and the laboratory test to verify the normal coagulation, epidural anesthesia was performed in this case.

The main cause of epidural anesthesia performed are as follows. The first is to avoid the use of sedatives, analgesics, and neuromuscular blockers. Epidural anesthesia may avoid respiratory depression and muscle weakness due to general anesthetics, opioids, and neuromuscular blockers. During normal cesarean section, 2% lidocaine was often used for epidural anesthesia. Patients with severe hypothyroidism are very sensitive to anesthetic drugs and may have poor tolerance of surgery. So, in this case, 1.5% lidocaine was used, and satisfactory anesthetic effect without any side effects was observed. Second, epidural anesthesia is accomplished with a decreased risk of the effects of sedatives and analgesics transferred from mother on the newborn.

Anesthesia may cause the incidence of heart failure elevated in hypothyroid patient. The main reasons are as follows. The capacity of circulation is not sufficient. The sympathetic nerve is blocked, which decreases the resistance of vascular and the blood pressure. However, this effect could be partially inversed by a classic agent, ketamine, which has unique central sympathomimetic, vagolytic and analgesic properties^[12]. ketamine certainly was not a first-line anesthetic, but an excellent complementary drug because of its wide margin of safety in relation to vital functions. When ketamine was used, ventilatory depression was scant, and there was a slight increase in the duty cycle confirmed

by Eikermann's ^[13]. It was also confirmed that ketamine can be used in spontaneous ventilation and that the airway remains unobstructed. Although obstructive sleep apnea was common in hypothyroid patient ^[14], in this case, the patient had no symptoms to indicate airway obstruction. In addition to the effect on the cardiovascular and respiratory system, low dose ketamine could protect the patient against intraoperative nausea and vomiting during CS ^[15]. In our case, low doses ketamine (1mg/kg) was used to complement in sedation and analgesia, and became a reasonable candidate for epidural anesthesia in the patient with severe hypothyroidism. It was important that ketamine intravenous should not be given at more than 1mg/kg in this severely high-risk patient.

In conclusion, we report the rare case of a parturient with severe maternal thyroid deficiency during CS at term. In high-risk patients, we recommend strongly that epidural anesthesia in combination with low dose ketamine may be an optimal and safe technique. we also suggest that when possible, primary thyrotropin or thyroxine (T₄) testing, the mainstay of newborn screening, should be performed between 2 and 5 days of life for the newborn.

Abbreviations

T3: Triiodothyronine; TGAbs: thyroglobulin autoantibody; TSH: thyroid stimulating hormone; CS: cesarean section

Declarations

Ethics approval and consent to participate

Written informed consent was obtained from the patient. The consent form will be provided upon request.

Consent for publication

Written informed consent was obtained from the patient for publication of the case report. A copy of the written consent is available for review by the Editor of this journal.

Availability of data and materials

All data related to this case report are contained within the manuscript.

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

Xiaoqin Jiang was a major contributor in writing the manuscript. Lan Wu conducted intraoperative management. Dong lu contributed clinical studies, data acquisition, manuscript editing. Wei Huang also provided a critical revision. All authors have read and approved the final version.

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