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Case Report

Intravenous dexmedetomidine as an adjuvant in anesthetic management of a paturient for cesarean section with uncontrolled hyperthyroidism

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Abstract: Parturients with uncontrolled hyperthyroidism presenting as urgent cesarean section are at high-risk. A 34-year-old, G4P3 parturient, at 34^{+5} weeks of gestation, with uncontrolled hyperthyroidism presented for urgent cesarean section. A combined spinal-epidural anesthesia was performed. Intravenous dexmedetomidine, as an adjuvant, was specifically administered during and after the surgery. Approximately 30 min after administrating of dexmedetomidine, materal heart rate and blood pressure gradually remained stable. The baby was delivered 36 min after infusion of the dexmedetomidine with a total use of 83 μg. The Apgar score was 7 at 1 min and 10 at 5 min, respectively. The fetal concentration of dexmedetomidine (608 pg/mL) indicates significant placental transfer, but significant adverse neonatal effects were not observed. Dexmedetomidine was very effective in the control of the sympathetic hyperactivity with no adverse effects on both mother and neonate in this case.

Keywords: Combined spinal-epidural, cesarean section, dexmedetomidine, pregnancy, hyperthyroidism

Introduction

Hyperthyroidism during pregnancy is uncommon and has been reported as occurring in 0.05-3.0% of pregnancies [1, 2]. Patients with uncontrolled hyperthyroidism presenting as an emergency are at high-risk, which caused by the thyrotoxic crisis.

Dexmedetomidine, is a highly selective α-2 adrenergic receptor agonist with several diverse actions like sedation, anxiolysis, sympatholysis, analgesia, and decreased intraoperative anesthetic requirements. Dexmedetomidine can lead to a decline in blood pressure and heartrate and thus has a good effect in the control of the stress response [3].

In this report, the successful use of intravenous dexmedetomidine as an adjuvant in combined spinal-epidural anesthesia (CSEA) for cesarean section in a parturient with uncontrolled hyperthyroidism is described.

Case report

A 34-year-old, 68 Kg, 158 cm, G4P3 parturient, at 34^{+5} weeks of gestation, was admitted in hospital for premature spontaneous rupture of membranes. She had no significant medical, surgical, or obstetric history. She reported a three-month history of sweating, agitation and palpitations.

On examination, vital signs were blood pressure 140/85 mmHg, heart rate 130 beats/min, respiratory rate 28 breaths/min and temperature 37.6°C. Palpation revealed enlarged thyroid gland I degree. Thyroid function tests immediately confirmed the clinical suspicion of uncontrolled hyperthyroidism with a free triiodothyronine (FT_3) of 15.19 pmol/L (normal range, 3.5-6.5 pmol/L), a free thyroxine (FT_4) of 56.58 pmol/L (normal range, 11.5-22.7 pmol/L), and a thyroid-stimulating hormone (TSH) of 0.007 mIU/L (normal range, 0.55-4.78 mIU/L). Her hemoglobin was 10.1 g/dL and bio-

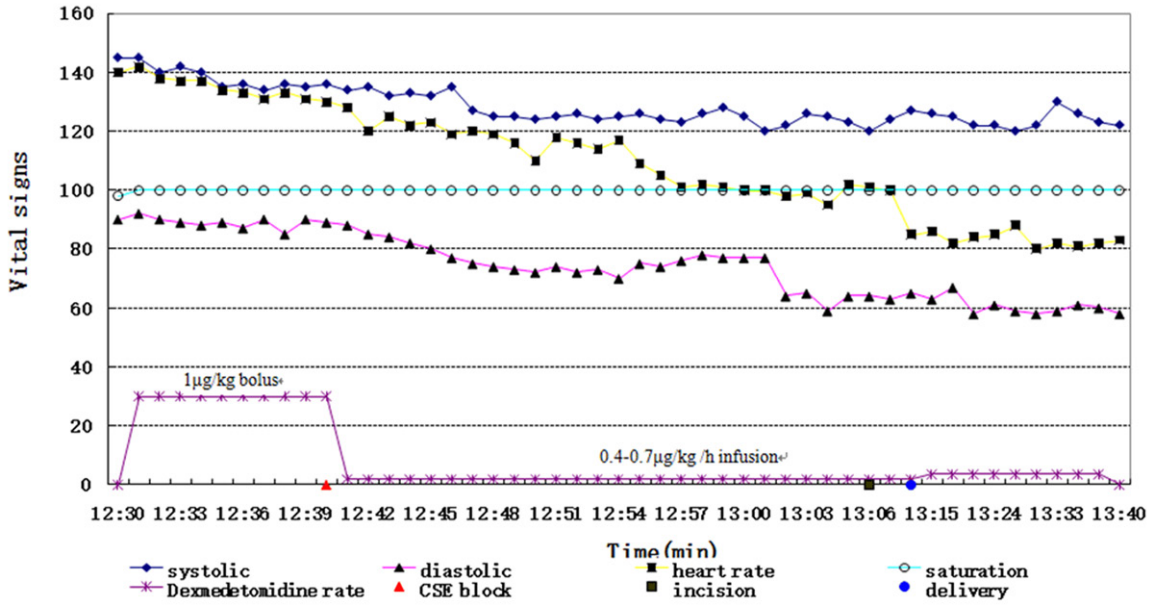

Figure 1. Vital signs during dexmedetomidine infusion during the surgery. Vital signs were recorded every minute before delivery and every 3 minute after delivery.

chemical profile was normal. Echocardiography indicated a sinus tachycardia. Cardiac ultrasonography revealed no abnormalities in left ventricular function. Unfortunately, the fetal distress forced urgent cesarean section with uncontrolled hyperthyroidism. Antithyroid drugs propylthiouracil (150 mg) and propranolol (20 mg) were given orally 1 hour before surgery. Postoperative intensive care unit (PICU) admission was also anticipated. A signed written informed consent of using dexmedetomidine was obtained from the parturient before surgery.

In the operating room the parturient was monitored in accordance with standard clinical protocols. Vital signs were non-invasive blood pressure 145/90 mmHg, heart rate 140 beats/min, respiratary rate 30 breaths/min, temperature 37.9°C and oxygen saturation 98% on room air. Vital signs were recorded every minute before delivery and every 3 minute after delivery (**Figure 1**). Dexmedetomidine 1 μg/kg was administered intravenously over 10 min. The maternal blood pressure did not change from baseline, and the heart rate dropped from 140 beats/min to 130 beats/min, fetal heart rate remained between 150 and 160 beats/min with moderate variability. Subsequently, a continuous dexmedetomidine infusion was initiated at 0.4 μg/kg/h. CSEA were performed 6 min after dexmedetomidine infusion in the left lateral position by median approach using needle-through-needle technique at L3/4 interspace. Eleven mg intrathecal isobaric 0.5% bupivacaine through a spinal needle after free flow of cerebrospinal were administrated over 15 s. A multiple orifice epidural catheter was threaded 4 cm into the epidural space. The patient was immediately helped into the supine position with a 10° left lateral tilt.

Thirty-six min after infusion of the dexmedetomidine, the surgery was started. Approximately 40 min after administrating of dexmedetomidine, her heart rate gradually decreased to 100 beats/min and blood pressure decreased to 125/77 mmHg, then remained stable. The baby was delivered 6 min after skin incision, 42 min after infusion of the dexmedetomidine with a total use of 83 μg. At the time of delivery the maternal peripheral venous dexmedetomidine concentration was 820 pg/mL, umbilical arterial concentration 608 pg/mL and umbilical venous concentration 630 pg/mL (measured by Huaxi Research Institute). Umbilical arterial blood gas analysis revealed a pH 7.35, PCO_2 6.25 kPa (46.9 mmHg), PO_2 3.91 kPa (29.3 mmHg). The Apgar score was 7 at 1 min and the neonate initially required backslap and suction.

At 5 min of age his heart rate was 152 beats/min and the Apgar score was 10. Neurobehavioral and physical examinations were normal at 15 min. The baby was taken to the neonatal intensive care unit (NICU) for observation because of small-for-gestational age at delivery.

After the baby was delivered, the dexmedetomidine was increased to 0.7 μg/kg/h. Through the surgery the patient maintained an adequate respiratory rate and oxygen saturation was around 100%. Temperature remained between 37.5 and 37.7°C. No additional epidural anesthetic was required during surgery. The duration of the surgery was 34 min. Total blood loss was 400 ml, urine output was 300 ml, and total infused crystalloid was 2000 ml. At the end of surgery, dexmedetomidine was continued, with a total use of 105 μg over 70 min. At this time, her blood pressure was 122/58 mmHg and heart rate 83 beats/min. Then she was transferred to the PICU.

On arrival to the PICU, antithyroid drugs propylthiourcil (100 mg 8-hourly) and propranolol (10 mg 8-hourly) were given orally and the vital signs remained stable. Dexmedetomidine was continually infused ranging from 0.2 to 0.5 μg/kg/h for two days with a total use of 890 μg. Postoperatively analgesia was provided through epidural catheter by sufentanyl and bupivacaine via a patient-controlled analgesia device 3 hours after surgery, last 3 days. (5 ml/h infusion, 4 ml bolus with a 20 min lock-out time). FT_3 and FT_4 normalized 14 days and TSH normalized 46 days postoperatively. Hyperthyroidism was finally controlled and the patient was discharged to home on the 16th postoperative day with a healthy infant.

Discussion

This patient presented multiple challenges for the anesthesiologist. She diagnosed with hyperthyroidism just several hours after admission and presented for urgent cesarean section because of fetal distress, did not allow such preoperative specific treatments to be taken. Uncontrolled hyperthyroidism may potentially develop a thyroid storm during perioperative period which is associated with a mortality of between 20 and 60% [4]. The frequency of small-for-gestational age infants may increase in those who remain hyperthyroid (26.7% vs 7.7%) compared with those who were euthyroid throughout pregnancy [5]. In our case, a premature infant was delivered.

Both general and regional anesthesia were successfully used in patients with hyperthyroidism during urgent surgery in previous cases [6, 7]. We performed a CSEA due to its effective use in reducing sympathetic overactivity.

This patient was treated with propylthiouracil and propranolol preoperatively and then we use a CSEA and dexmedetomidine to further blunt the hemodynamic responses created by the thyroid storm. Futhermore, the total infused crystalloid in this patient was more than other patients in cesarean section because that fluid resuscitation are necessary to minimize the risk of precipitating thyroid storm. All in combination, contributed to the successful outcome.

As the safety of dexmedetomidine that used in intrathecal route in humans has not been extensively studied, intravenous dexmedetomidine was finally chosen. Dexmedetomidine can lead to a decline in blood pressure and heart rate and attenuate the increase of norepinephrine during surgery [3, 8]. When used as an adjuvant to spinal anesthesia it can prolong the duration of sensory block, motor block, and time to first analgesic request, but needs more atropine to reverse bradycardia [9, 10]. However, the decline of heart rate was benificial for this patient since she had symptoms of tachycardia associated with hyperthyroidism. Furthermore, no bradycardia was found in this case. After administration of dexmedetomidine, she remained cooperative to complete the CSEA and was easily aroused during surgery, which is different from other sedatives [11]. Through the surgery the patient maintained an adequate respiratory rate without any respiratory depression.

According to the standard dosing regimens for sedation in critically ill patients, a 1 μg/kg loading infusion administered over 10 min followed by a continuous infusion of 0.2 to 0.7 μg/kg/h dose was suggested. While the total doses of dexmedetomidine used in spinal anesthesia were a initial loading doses ranging from 0.5 and 1 μg/kg followed by maintenance infusion of 0.2 and 0.5 μg/kg/h [9, 12-14]. We decided to use a 1 μg/kg loading dose over 10 min and a higher continuous infusion rate of 0.4 to 0.7 μg/kg/h in the surgery considering better control of hypertension and tachycardia.

Though dexmedetomidine is an off label use in parturients, there is a lot of literature available that describes successful use of dexmedetomidine in animals and humans without any negative effects on neonates [3, 8, 15-19]. After administration of a total of 83 μg of dexmedetomidine over 42 min, the umbilical artery concentration of dexmedetomidine was 608 pg/mL and the fetal/maternal (F/M) concentration ratio was 0.74, indicating significant fetal exposure to dexmedetomidine. This value is consistent with the F/M ratio of 0.77 ± 0.06 found by Ala-Kokko et al. in isolated perfused human placentas [20]. The neonate was delivered without fetal bradycardia and umbilical cord blood gas analysis was within normal limits. Lower Apgar score (7.1 min) probably relate to small-for-gestational age at delivery and uncontrolled hyperthyroidism. The presence of dexmedetomidine could have contributed to the low Apgar scores, however, in this case, the neonate recovery rapidly and fifteen minutes after delivery the neonatal neurobehavioral and physical status was normal. Significant adverse neonatal effects were not observed.

Antithyroid drug propylthiourcil and propanolol were started according to the endocrinologist's advice after surgery. Following our hospital's protocol, we chose epidural analgesia which permitted us to provide the correct pain treatment during postoperative time. The dexmedetomidine was continued after surgery in PICU for two days considering its significant analgesic and sympatholytic properties by providing sedation without respiratory depression or compromise.

In conclusion, intravenous dexmedetomidine was used successfully as an adjuvant in CSEA for cesarean section in a parturient with uncontrolled hyperthyroidism. Although pharmacokinetic data cannot be determined, no adverse effects on both mother and neonate was found.

Acknowledgements

Before the treatment to this patient, we have already obtained the consent from the patient.

Disclosure of conflict of interest

None.

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