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Use of dexmedetomidine on parturient women and newborns after cesarean section

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Keypoints

Purpose of the study is to study the effect of intravenous dexmedetomidine during cesarean section under spinal anesthesia in women with preeclampsia on the vital functions of the mother and newborns in the early neonatal period.

Abstract

Introduction

Special requirements are imposed on anesthetic care in obstetrics, especially in preeclampsia: it is necessary to ensure protection of the mother's body from surgical trauma and, at the same time, to prevent negative impact on the fetus, to maximally preserve its adaptive regulatory mechanisms responsible for postnatal adaptation. Preeclampsia is one of the most common complications of pregnancy, which leads to significant disruptions in the main life support systems of mothers in labor, up to and including death. **Purpose of the study:** To study the effect of intravenous dexmedetomidine during cesarean section under spinal anesthesia in women with preeclampsia on the vital functions of the mother and newborns in the early neonatal period.

Material and Methods

The study was conducted at the Scientific Research Institute of Obstetrics and Gynecology in Baku. A prospective, double-blind, randomized, controlled clinical study of 110 parturient women with preeclampsia was conducted.

Results and discussion

After a 10-minute intravenous loading dose of dexmedetomidine in patients of group II, the degree of sedation was 2.2±0.24 points. At the height of anesthesia before skin incision, RASS in group I increased by 10.9% to moderate, and in group II it decreased accordingly by 8.6% (P>0.05) to mild. After fetal extraction, RASS in group I increased by 15.2% (P<0.05) by the end of the operation and 8 hours after its completion decreased by 9.8 (P>0.05) and 78.8% (P<0.05), respectively, relative to the initial stage. In the second group, the degree of sedation at all stages of the study according to RASS remained stable within the range of –2.2 and –1.9 points (P>0.05)

Keywords

dexmedetomidine, preeclampsia, newborns

Introduction

Special requirements are imposed on anesthetic care in obstetrics, especially in preeclampsia: it is necessary to ensure protection of the mother's body from surgical trauma and, at the same time, to prevent negative impact on the fetus, to maximally preserve its adaptive regulatory mechanisms responsible for postnatal adaptation. Preeclampsia is one of the most common complications of pregnancy, which leads to significant disruptions in the main life support systems of mothers in labor, up to and including death. According to the World Health Organization, preeclampsia is the cause of about 70,000 maternal and 500,000 infant deaths annually worldwide. Preeclampsia, especially its severe form, often leads to

delivery by cesarean section, being the only method of treating this pregnancy complication. The choice of anesthetic assistance during cesarean section in modern obstetrics is becoming especially relevant, as it should promote adequate protection of the pregnant woman from surgical stress, create optimal conditions for fetal adaptation in the perioperative and neonatal period. An anesthesiologist plays a much larger role in modern obstetrics than simply administering anesthesia during a cesarean section and providing care in the immediate postpartum period. A cesarean section is one of the most common birthing surgeries used in obstetric practice. To ensure a cesarean section in this category of patients, general multicomponent anesthesia and one of the types of regional anesthesia (spinal or epidural) are mainly used. However, it should be taken into account that general anesthesia, despite being a controlled anesthesia, is always accompanied by a hyperdynamic reaction to tracheal intubation, difficulties in ensuring airway patency resulting from physiological changes during pregnancy, and depression of the newborn's breathing in the early neonatal adaptation period. Regional anesthesia is the "gold standard" for cesarean section in many clinical situations. However, its absolute advantage over general anesthesia, such as ease of implementation, cost-effectiveness, reliable nociceptive protection, and minimal impact on the fetus and newborn, is offset by the occurrence of possible side effects and complications, such as hemodynamic disturbances, high spinal block, visceral pain, and short-term postoperative analgesia.

The issue that worries many anesthesiologists is the search for a drug that has analgesic, sedative, hemostatic and sympatholytic effects. The most complete list of these properties corresponds to the new selective agonist of central α_2 -adrenoreceptors - dexmedetomidine. This drug binds with a high degree of affinity to α_2 -adrenoreceptors of all three subtypes (α_2 A, α_2 B and α_2 C) and is their full agonist. In this it differs from the prototype agonist of α_2 -adrenoreceptors clonidine, which is a partial agonist of receptors of the α_2 A and α2 C subtypes and has a negligible effect on receptors of the α_2 B subtype. In addition, dexmedetomidine, compared to clonidine, is a more potent agonist of the α_2 A and α_2 C receptor subtypes, as well as a more selective and specific agonist of α_2-adrenoreceptors, while having only low affinity for α_1-adrenoreceptors and low functional activity in relation to these receptors. The molecule dexmedetomidine was discovered in 1986 by the Finnish pharmaceutical company Pharmos-Medipolar. Since the U.S. Food and Drug Administration (FDA) approved the drug in the U.S. in 1999, DM (Precedex, Hospira Inc., Lake Forest, IL, U.S.) has been approved in the U.S. and many other countries, including Japan and Canada, for use as a sedative in previously intubated, ventilated patients during intensive care unit treatment, and in non-intubated patients prior to and/or during surgery or other procedures. It reduces the need for anesthetics and cardiovascular reactions associated with general anesthesia, and reduces surgical stress. Almost all anesthetics act on the cerebral cortex, causing a non-physiological sedative effect, while dexmedetomidine acts on the subcortical system. In this regard, the awakening function is still preserved, and drug-induced sleep can be eliminated by verbal or physiological stimulation. Dexmedetomidine reduces the release of norepinephrine by stimulating the α_2-adrenergic receptor on the presynaptic membrane and blocks the transmission of pain impulses, which in turn suppresses the activity of sympathetic stimulation and leads to a decrease in hemodynamic response and sedative effects. However, clinical studies have shown that dexmedetomidine can cause bradycardia and a decrease in blood pressure. There are clinical studies of the efficacy and safety of intravenous dexmedetomidine during cesarean section, but there is no comprehensive assessment of its impact on the main life support systems of the mother and newborn in the early adaptation period.

Purpose of the study: To study the effect of intravenous dexmedetomidine during cesarean section under spinal anesthesia in women with preeclampsia on the vital

functions of the mother and newborns in the early neonatal period.

Material and Methods

The study was conducted at the Scientific Research Institute of Obstetrics and Gynecology in Baku. A prospective, double-blind, randomized, controlled clinical study of 110 parturient women with preeclampsia was conducted. The inclusion criteria for pregnant women in the study were preeclampsia, gestation period of 37–39 weeks, anesthesia risk according to ASA stage II, with arterial hypertension (SystBP <160 mm Hg and DiastBP <110 mm Hg), proteinuria (more than 0.3 g/l), patients with a uterine scar and disease of the operated uterus, anatomically narrow pelvis, high myopia. Exclusion criteria were: cardiovascular diseases, morbid obesity, multiple pregnancy, chronic non-specific and acute lung diseases. In the preoperative period, all patients received nifedipine (10 mg 3-4 times a day). All parturient women underwent compression of the lower extremities with elastic bandages or stockings before surgery. The study groups were comparable in age, weight, anesthetic risk according to ASA (I-II), gestational age and extragenital pathology. The duration of the surgical intervention varied within 40-60 minutes. All patients were divided into 2 groups. In the control group I (n = 55) patients only spinal anesthesia was performed. Subarachnoid space puncture was performed at the level of L2–L4 with Pencil-Point G 27 needles in a sitting position. 0.5% hyperbaric bupivacaine solution was slowly injected over 2 min. The anesthetic dose was calculated according to the proposed dosage. In the II (n = 55) main group, 0.5 mcg/kg dexmedetomidine was first administered intravenously for 10 min before spinal anesthesia, the maintenance dose was 0.7 mcg/kg/h throughout the operation until its completion. Then spinal anesthesia was performed on the side. Surgical intervention began after the appearance of all signs of motor and sensory blockade, usually within 5 minutes. Replacement of intraoperative blood loss, which averaged 5–6 ml/kg, was generally not performed. However, the total volume of infusion therapy was 10–12 ml/kg crystalloids. If blood pressure decreased by more than 30% from the initial value, phenylephrine was additionally administered intravenously at a rate of 0.2 mcg/kg/min; if bradycardia was less than 50 beats per minute, atropine 0.4 mg was administered intravenously. Vital functions were assessed using conventional clinical signs, SBP, HR, SpO2, and ECG on a cardiac monitor. Sedation was assessed using the Richmond RASS scale. Newborns were assessed using the Apgar scale at 1 and 5 minutes. The studies were conducted at 5 stages: 1st - on the operating table before anesthesia, 2nd - before the skin incision at the height of anesthesia, 3rd - immediately after the extraction of the fetus, 4th - after the end of the operation, 5th - 8 hours after the end of the operation.

Results and discussion

After a 10-minute intravenous loading dose of dexmedetomidine in patients of group II, the degree of sedation was 2.2±0.24 points. At the height of anesthesia before skin incision, RASS in group I increased by 10.9% to moderate, and in group II it decreased accordingly by 8.6% (P>0.05) to mild. After fetal extraction, RASS in group I increased by 15.2% (P<0.05) by the end of the operation and 8 hours after its completion decreased by 9.8 (P>0.05) and 78.8% (P<0.05), respectively, relative to the initial stage. In the second group, the degree of sedation at all stages of the study according to RASS remained stable within the range of –2.2 and –1.9 points (P>0.05) (Table 1).

Indicators	Indicators	Stages				
		I	II	III	IV	V
SBP mmHg	I	112,5±1,6	102±1,6*	97,2±1,2*	91,3±1,6*	100,3±1,1*,**
	II	104,3±1,4	93±1,7*	91,3±1,3	90,2±1,2*	90,1±1,0*
Heart rate in min.	I	85,2±1,44	81,4±1,1*	84,6±1,3*	83,1±1,44*	81,1±0,92*
	II	81,1±1,11	76,5±1,2	82,2±0,93*	81,4±1,31*	80,2±1,2

Table 1. Vital Signs During Intravenous Dexmedetomidine Sedation for Cesarean Section. Note: * reliability of differences in outcome; ** (P < 0.05).

Newborns were assessed at birth using the Apgar scale at 1 and 5 minutes. It was found that children born in the second group (with dexmedetomidine) had higher Apgar scores at the 1st minute by 8.5%, and at the 5th minute by 6.9% ($P<0.05$) relative to those in the first group.

Preeclampsia is one of the most common complications of pregnancy, which leads to significant disturbances in the vital functions of mothers in labor and the birth of children in asphyxia of varying severity. And one of the main methods of treating this complication of pregnancy is early delivery by cesarean section. An analysis of numerous literature has shown that there are currently quite contradictory data on the effect of dexmedetomidine on the main vital functions of women with preeclampsia and the condition of newborns at birth. Therefore, in our work, we decided to continue research on the use of dexmedetomidine in patients with preeclampsia and their newborns. A comparative assessment of the effect of dexmedetomidine on the level of consciousness (RASS) showed that sedation caused by dexmedetomidine is characterized by easier awakening of patients, which ensures their more effective interaction and communication with medical personnel, amounting to 2.2±0.24 points after a loading dose, while in group I it was 2.8±0.2, which was typical for moderate sedation and difficult contact with personnel. After the extraction of the fetus, the level of sedation was also characterized as moderate, in the second, as mild - 2.1±0.1 points, which had a positive effect on the psycho-emotional state of the woman in labor in terms of communication with the child. The observed decrease in heart rate and blood pressure in the mother is most likely associated with the activation of central postsynaptic α_2-adrenergic receptors by dexmedetomidine, which leads to a decrease in sympathetic activity with a subsequent decrease in blood pressure and heart rate. Infants born in the spinal anesthesia only group showed lower Apgar scores at 1 and 5 minutes after birth. Thus, the mothers in the dexmedetomidine group were almost always more capable of awakening than the patients in group I without the use of dexmedetomidine, and were distinguished by better hemodynamic stability, antinociceptive protection against surgical stress, and the newborns of this group at birth showed a higher level of adaptation in the early neonatal period.

Conclusion

1. Intravenous administration of a loading dose of dexmedetomidine 0.5 mcg/kg during premedication and a maintenance dose of 0.7 mcg/kg/h provides mild sedation according to the RASS scale and is characterized by more effective interaction with medical personnel and newborns at birth.
2. Assessment of the Apgar score in newborns at birth showed that in the group of patients who did not use dexmedetomidine, newborns at birth had a higher risk of maladaptation in the early neonatal period.

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