OPTIMIZATION OF DRUG-INDUCED SEDATION WITH VARIOUS AGENTS DURING SPINAL ANESTHESIA FOR CESAREAN SECTION

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Abstract *The choice of anesthetic strategy for cesarean section is critically important, as it must ensure not only reliable protection of the woman from surgical stress but also promote favorable adaptation of the fetus during the perioperative and neonatal periods. The role of the anesthesiologist in modern obstetric practice extends far beyond simply administering anesthesia, encompassing the management of the patient in the immediate hours and days after delivery. The problem of sedation in obstetric intensive care units is of undeniable scientific and practical relevance worldwide.*
Keywords*: sedation, obstetric, anesthesiology, dexmedetomidine*

Introduction. Various adjuvants, such as morphine, fentanyl, clonidine, and ketamine, have long been in use. However, such adjuvants are undesirable from an anesthesiology standpoint. The search for an effective adjuvant is still ongoing. Yet, the question of the efficacy and safety of this approach in pregnant women, particularly in the obstetric population, remains unresolved. More recently, a relatively new α2-adrenergic agonist, dexmedetomidine, has been used for this purpose.

Objective. To improve the efficacy of drug-induced sedation with dexmedetomidine during spinal anesthesia in pregnant women undergoing cesarean section.

Materials and methods of research: This paper presents data obtained from a prospective analysis of medical histories, anesthesia records, intensive care charts, and the results of functional and biochemical studies of 40 women without severe extragenital pathology, with an ASA physical status classification of 2, at 37-39 weeks of gestation. The patients were treated in the obstetrics department of the Samara State Medical University (SamSMU) multidisciplinary clinic.

Indications for spinal anesthesia (SA) included uterine scars from a previous abdominal delivery, a history of conservative myomectomy, pregnancy combined with uterine myoma or other gynecological pathology, and placenta previa. In the operating room, all women underwent intravenous premedication with diphenhydramine (0.2 mg/kg) and dexamethasone (0.07 mg/kg) after compression bandaging of the lower extremities. Following a pre-emptive infusion of saline solutions (6-8 ml/kg), subarachnoid puncture was performed under local infiltration anesthesia with the patient in a sitting position, using a 25G "Pencil-point" needle at the L2-L4 level. The local anesthetic (LA) used was either a 0.5% isobaric bupivacaine solution (HWARDS, Pakistan) or a 0.5% hyperbaric Longocain-Heavy solution ("Yuria Pharm") at a dose of 12 ± 3.0 mg. To prevent aortocaval compression, patients were placed in a "left uterine displacement" position with a 20° tilt until fetal extraction. The intraoperative fluid management program was based primarily on the administration of crystalloids and balanced colloids at a rate of 8-10 ml/kg/hour. The operation commenced 10-15 minutes after the development of all clinical signs of segmental sensory-motor blockade at the required level for the surgical intervention. To reduce psycho-emotional stress, women in the 1st (main) group received dexmedetomidine as the hypnotic component, administered as a loading dose of 1 mcg/kg over 10 minutes, followed by a maintenance dose of 0.2-0.7 mcg/kg/h for the duration of the surgery. The 2nd (control) group received various sedatives as the hypnotic component. For women in the 2nd subgroup, Ketamine 0.5-0.7 mg/kg was used as the hypnotic component; for women in the 3rd subgroup, Propofol 5-10 mcg/kg/min was used; for women in the 4th subgroup, Sibazon (Diazepam) 0.2 mg/kg was used as the hypnotic component after fetal extraction; and for women in the 5th subgroup, sodium oxybate was used as the hypnotic component after fetal extraction at a dose of 20-40 mg/kg. It should be noted that for all patients in the 4th and 5th subgroups, drug-

induced sedation was initiated after the umbilical cord was clamped. All patients who underwent surgery were transferred to the intensive care unit for appropriate syndrome-based therapy and 24-hour monitoring of vital functions.

Results and discussion. During abdominal delivery, the dosage of sedatives is usually reduced or withheld entirely before the fetus is extracted, which can lead to insufficient sedation and patients experiencing awareness during surgery. One of the promising methods for assessing the depth and degree of anesthesia and medical sedation is the Bispectral Index (BIS), therefore, to determine the efficacy and level of sedation depth for the medical sedation options we studied alongside SA, the BIS index and the RASS (Richmond Agitation-Sedation Scale) were examined in all 200 patients included in the study group. All the women we studied were divided into five groups. The first, main group consisted of 100 pregnant women who received dexmedetomidine for medical sedation during the intraoperative period. For medical sedation, a loading dose of dexmedetomidine of 0.5-0.7 mcg/kg was administered over 10 minutes, followed by a maintenance dose that ranged from 0.2 mcg/kg/h until the completion of the surgery. Depending on the sedatives used, the participants in the control groups were divided into four subgroups: the 2nd, 3rd, 4th, and 5th, with 25 pregnant women in each. Women in the 2nd group received ketamine 0.5-0.7 mg/kg as the hypnotic component, the 3rd group received propofol 0.5-1 mg/kg, the 4th group received sibazon 0.2 mg/kg, and women in the 5th group received sodium oxybutyrate at a dose of 20-40 mg/kg. For all patients in the 4th and 5th groups, medical sedation was initiated after the umbilical cord was clamped.

The BIS index results for pregnant women in all groups are presented in Table 4.2 and Figure 4.2. As can be seen from Table 4.2, the monitored values of the BIS index and the RASS scale in all groups, from the beginning to the end of the operation, were within the acceptable target ranges at most stages of the study. Thus, in patients of the 1st group, who received dexmedetomidine for medical sedation under SA, the BIS index was 80-90, which indicated the development of light sleep at all observation stages. At the same time, before the skin incision, the RASS score was -2.1±1.1, and after fetal extraction, it was -2.7±1.3, which is characteristic of light to moderate sedation. After the surgery and transfer from the operating room, the women were in a drowsy state, with a RASS score of -1.1±1.2. No depressive effect of dexmedetomidine was observed at any stage of the study.

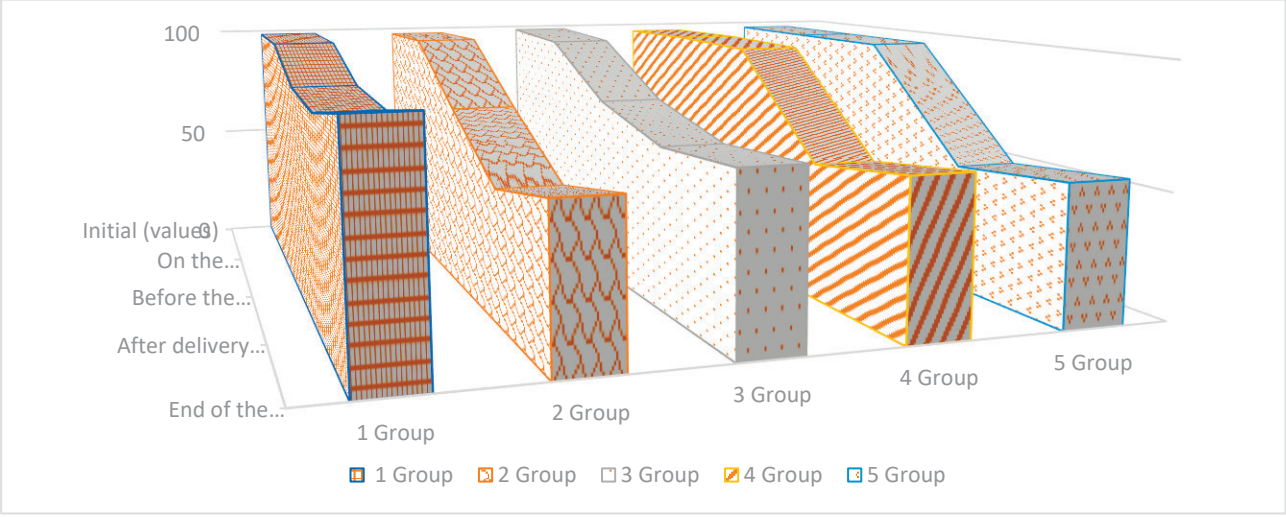


Fig. 1. BIS index values in women undergoing surgery with spinal anesthesia and medical sedation in the main and control groups. Baseline values are taken as 100%

The study of patients in groups 2 and 3 showed that in the groups where ketamine (group 2) and propofol (group 3) were used, it was possible to use even lower doses.

Table 1.

Some indicators of the depth of medical sedation (BIS index and RASS scale) in women undergoing surgery with spinal anesthesia and medical sedation in the main and control groups

Para-meters	Baseline values	On the operating table	Before skin incision	After delivery of the fetus	End of the operation	p
1	2	3	4	5	6	7
1 group						
BIS	98,1±1,2	98,0±1,1	85,2±2,3* **	83,1±4,1*	91,2±2,1***	p<0,001
RASS	+0,5±0,2	+0,9±0,2	-2,1±1,1* **	-2,7±1,3* **	-1,1±1,2***	p<0,0001
2 group						
BIS	97,2±1,7	98,2±0,4	74,1±2,4* **	52,2±3,1* ** Δ	61,4±4,2*** Δ	p<0,001
RASS	+0,6±0,2	+0,8±0,2	-3,1±2,1* ** Δ	-4,1±1,4* ** Δ	-2,2±1,3*** Δ	p<0,001
3 group						
BIS	98,2±1,2	96,3±1,4	75,1±2,4 * **	65,1±2,2* ** Δ	68,1±2,4*** Δ	p<0,05
RASS	+0,4±0,3	+0,7±0,2	+0,8±0,1*	-4,1±1,1* ** Δ	-2,1±1,1*** Δ	p<0,001
4 group						
BIS	96,4±2,6	97,2±1,1	96,4±2,3* ** Δ	55,1±2,3* Δ	62,1±1,8*** Δ	p<0,001
RASS	+0,4±0,2	+0,8±0,1	+2,3±0,5* ** Δ	-4,1±1,2* ** Δ	-2,3±1,4*** Δ	p<0,0001
5 group						
BIS	97,2±1,1	97,1±1,4	97,1±2,1*	51,1±3,2* ** Δ	56,1±3,3* Δ	p<0,001
RASS	+0,5±0,2	+0,7±0,2	+2,4±0,4*	-5,1±1,3* ** Δ	-4,1±1,5* Δ	p<0,05

*Note: * indicates statistically significant differences (p<0.05) compared to baseline values; ** indicates statistically significant differences (p<0.05) compared to previous stages of the study; Δ denotes statistically significant differences (p<0.05) between the main and control groups.*

non-inhalation anesthetics for drug-induced sedation, as the BIS index values dropped below 70% at the stage before the skin incision. At the stage after fetal extraction, the BIS index in the 2nd group was 52.2±3.1% (p2,3<0.05), and in the 3rd group, it was 65.1±2.2% (p2,3<0.05). Compared to the baseline data, this showed a significant decrease of 46.3% (p2,3<0.05) in patients of the 2nd group and 33.8% (p2,3<0.05) in patients of the 3rd group. It should be noted that in patients of the 3rd group, the main dose of propofol was administered after fetal extraction and clamping of the umbilical cord.

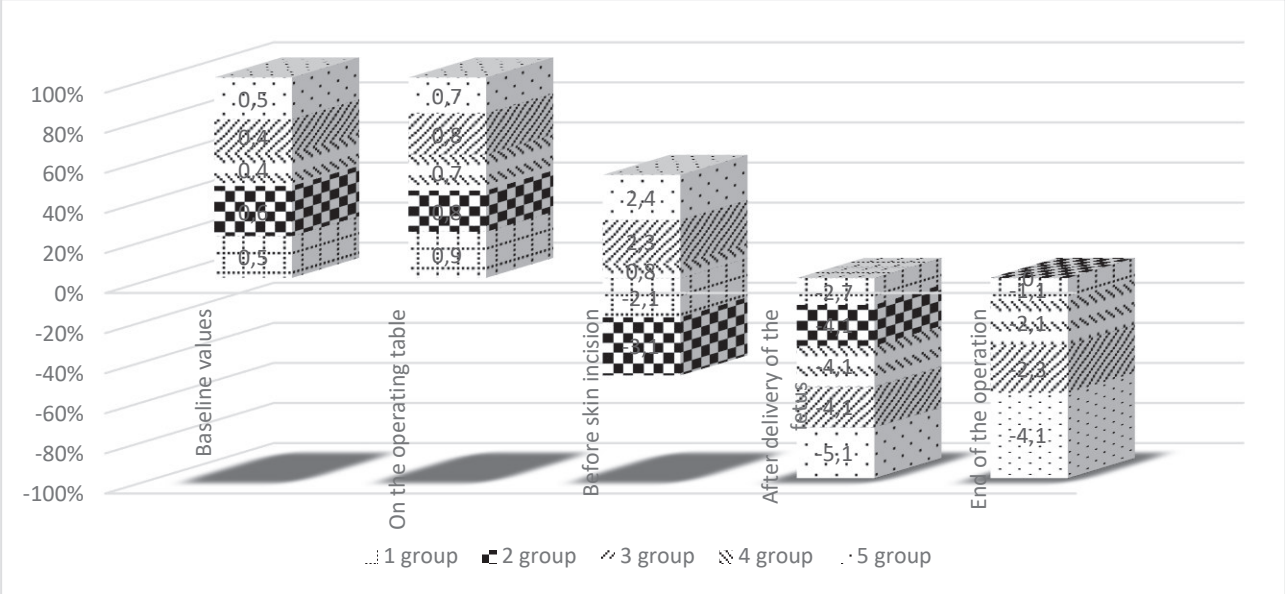


Fig. 2. RASS scale scores in women undergoing surgery with SA and drug-induced sedation, main and control groups. Baseline values are conventionally set at 100%.

When assessing the depth of sedation using the RASS scale in patients of groups 2 and 3, a decrease was noted compared to the previous stage and in comparison, with group 1. At the pre-incision stage, patients in group 2 showed a decrease of -3.1±2.1 points ($p_{2,3}<0.05$). At the stage after fetal extraction, the decrease was -4.1±1.4 points ($p_{2,3}<0.05$), which characterized the maximum effect of the drug after the full dose was administered and corresponded to deep sedation. When analyzing intergroup differences, it is noteworthy that patients in both groups 2 and 3 were in a deeper state of sedation at the end of the surgery and upon transfer to the intensive care unit compared to patients in group 1.

In women from the control groups 4 and 5, who were operated on under a complete segmental sensory-motor block following SA with drug-induced sedation using Sibazone (group 4) and sodium oxybutyrate (group 5) administered after fetal extraction and umbilical cord clamping, the following was observed: in women of group 4, the administration of Sibazone after umbilical cord clamping at the post-extraction stage led to a 55.1±2.3% decrease in the BIS index ($p_4<0.05$) and a reduction in sedation depth on the RASS scale by -4.1±1.2 points ($p_4<0.05$) (see Fig. 2).

In pregnant women of group 5, the administration of sodium oxybutyrate after umbilical cord clamping at the post-extraction stage led to a 51.1±3.2% decrease in the BIS index ($p_5<0.05$) and a reduction in sedation depth on the RASS scale by -5.1±1.3 points ($p_5<0.05$). This reduction indicated a clinical presentation of deep sedation, and in patients of group 5, a clinical presentation of general anesthesia. Of particular interest were the RASS scale results on the operating table and before the skin incision, prior to the administration of Sibazone (group 4) and sodium oxybutyrate (group 5). The RASS scale score was +2.3±0.5 and +2.4±0.4 points, respectively ($p_{4,5}<0.05$), and this increase was significant compared to the previous study stage and to the other study groups. Such an increase indirectly indicated a heightened fear of the surgery and of seeing the surgical team, which was reflected in the women's psycho-emotional behavior. In particular, mild to moderate sedation was noted with the use of dexmedetomidine at all study stages, with no depressive effect observed. In parturients who received ketamine (group 2) and propofol (group 3), deep sedation was observed at the stage after fetal extraction, which continued until the end of the surgery and upon transfer to the intensive care unit for patients in both groups. Moreover, pregnant women operated on under a complete segmental sensory-motor block following SA with drug-induced sedation using ketamine

(group 2), Sibazone (group 4), and sodium oxybutyrate (group 5) experienced deep sedation, while pregnant women in groups 2 and 5 exhibited a clinical picture characteristic of general anesthesia. During the stages before the start of drug-induced sedation, fear of the surgery increased in response to being touched by specialists and seeing the surgical team, which manifested as psycho-emotional overstrain.

Conclusions. 1. A comparative analysis of the effectiveness of drug-induced sedation with various agents showed that different sedation options had a dissimilar effect on the psycho-emotional state of parturients during the intraoperative period. Specifically, patients who received ketamine (group 2), propofol (group 3), and sodium oxybutyrate (group 5) experienced deep sedation, with RASS scores of -3.1±2.1, -4.1±1.4, and -5.1±1.3 points, respectively. Mild to moderate sedation with no depressive effect was observed in women using dexmedetomidine, with RASS scores of -2.1±1.1 and -2.7±1.3 points, respectively.

2. Drug-induced sedation with dexmedetomidine under SA in parturients showed no negative impact on major life-support systems and provided reliable protection of the body from surgical and anesthetic stress, which compares favorably with conventional drug-induced sedation options.

3. The developed method of drug-induced sedation with dexmedetomidine under SA during cesarean section is a highly effective and sufficiently safe method. The tested method does not have a pronounced negative impact on major life-support systems, while simultaneously maintaining reliable antinociceptive and psycho-emotional protection of the patient's body from surgical stress.

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