

# SOME INDICATORS OF THE EFFECTIVENESS OF THE USE OF CENTRAL BLOCKS IN CASES OF ABDOMINAL DELIVERY IN WOMEN WITH MODERATE MITRAL STENOSIS

<sup>1</sup>Muminov Abdukhalim Abduvakil, <sup>2</sup>Matlubov Mansur Muratovich, <sup>3</sup>Mamatkulov  
Isfandiyor Abdurakhmanovich

<sup>1,2,3</sup>Samarkand State Medical University

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**Abstract.** *The choice of method of anesthesia during cesarean section in patients with mitral stenosis (MS) was carried out taking into account the severity of stenosis and the functional state of the cardiovascular system at the time of delivery, taking into account the recommendations of the Association of Obstetricians and Gynecologists of the Republic of the Northern Central Medical Center named after. Academician I.I. Grekov of the Ministry of Health of the Republic of Uzbekistan. Central (neuraxial) blocks, especially spinal anesthesia, are recognized as the most preferred method of anesthetic management in case of cesarean section.*

**Keywords:** *autonomic, sympathoadrenal and hypothalamic-pituitary-adrenocortical systems.*

**Introduction:** The choice of method of anesthesia during cesarean section in patients with mitral stenosis (MS) was carried out taking into account the severity of stenosis and the functional state of the cardiovascular system at the time of delivery, taking into account the recommendations of the Association of Obstetricians and Gynecologists of the Republic of the Northern Central Medical Center named after. Academician I.I. Grekov of the Ministry of Health of the Republic of Uzbekistan. Central (neuraxial) blocks, especially spinal anesthesia, are recognized as the most preferred method of anesthetic management in case of cesarean section. However, the use of these methods in patients with reduced coronary reserves caused by MS may be accompanied by serious hemodynamic disturbances due to high segmental blockade and a decrease in the adaptive capabilities of the cardiovascular system. This is especially true for pregnant women with moderately severe MS with an area of 2.9-2.0 cm<sup>2</sup>, in whom circulatory failure and a hypokinetic circulatory regime develop already at 34-36 weeks of pregnancy. Thus, women with MS 2.9-2.0 cm<sup>2</sup> represent a high-risk group for the development of intra- and postpartum complications, requiring an individual approach in each clinical case. In this regard, the study of the state of hemodynamics in pregnant women with MS when using central blocks is important for determining a safe method of anesthesia in obstetric practice. Analysis of circulatory parameters, respiratory function, as well as indicators of the autonomic, sympathoadrenal and hypothalamic-pituitary-adrenocortical systems during anesthesia and surgery in pregnant women with moderately severe MS and with limited adaptive capabilities of the cardiovascular system during cesarean section requires special attention.

**Materials and methods:** The study is based on the results of clinical observations and a comprehensive analysis of clinical, functional and biochemical parameters during cesarean section in 51 women aged 20-28 years at a gestation period of 34-36 weeks. All patients had moderately severe mitral stenosis (MS) according to the classification of A. N. Okorokov. The indication for

premature delivery in this group of patients was progressive circulatory disorders associated with increasing gestational age, taking into account multifactorial criteria for maintaining coronary reserves. All 51 observations noted a decrease in the adaptive capabilities of the cardiovascular system. The operations were carried out as planned and lasted 30-60 minutes. The patients were divided into three groups depending on the method of pain relief. Group I (n=37) underwent surgery under spinal anesthesia (SA), group II (n=37) - under traditional epidural anesthesia (EA), and 27 patients in group III underwent epidural anesthesia with reduced concentrations of local anesthetic in combination with fentanyl and preventive analgesia. The anesthesia technique included the administration of diphenhydramine and dexamethasone in group I, and in groups II and III local infiltrative anesthesia and catheterization of the epidural space were used. The dose of bupivacaine hydrochloride was calculated taking into account the morphometric characteristics of the patients. Group III also received preventive analgesia with paracetamol. During the operation and after its completion, the effectiveness of anesthesia was assessed by clinical signs, level of sensory block, motor block and central hemodynamics. Pulmonary function and gas exchange were analyzed before, during and after surgery, as well as after 24 hours. The initial indicators of the preoperative period, characterizing the function of external respiration and gas exchange, were similar in the groups and were expressed by moderate hyperventilation, a decrease in minute ventilation and a decrease in hemoglobin oxygen saturation. These changes were associated with hemodynamic insufficiency caused by severe mitral stenosis.

During the operation, there was a decrease in pulmonary function indicators associated with blockade of the intercostal nerves, especially when using a CA. However, no clinical manifestations of respiratory depression were observed. After completion of the operation and after 24 hours, an improvement in the studied parameters was observed, with a clear tendency towards normalization. Patients in group III who received preventive analgesia showed less pronounced changes. Patients in group III who received preventive analgesia showed less pronounced changes. Thus, the study allows us to evaluate the effectiveness of various methods of anesthesia for caesarean section in women with moderate mitral stenosis and reduced coronary reserves, providing valuable information for choosing the safest method of pain relief in such clinical cases. The respiratory rate (RR) in groups 3, 4 and 5 was  $20.6 \pm 0.5$ ,  $19.8 \pm 0.3$ ,  $20.1 \pm 0.4$  per minute, respectively; minute ventilation (MV) –  $0.62 \pm 0.03$ ,  $0.63 \pm 0.04$  and  $0.61 \pm 0.03$  liters; minute lung volume (MVL) –  $48.8 \pm 2.0$ ,  $48.1 \pm 2.1$  and  $48.4 \pm 1.9$  liters per minute. The level of hemoglobin oxygen saturation (SpO<sub>2</sub>) was  $95.1 \pm 1.2$ – $95.3 \pm 1.3\%$ .

To assess the adequacy of anesthesia, we used the tension index (TI) by performing a mathematical analysis of heart rate (9). The level of total cortisol (TC) in blood plasma was also assessed using the radioimmunoassay method and the rate of norepinephrine (NA) excretion in urine (10).

The stages of the study included:

1. On the operating table.
2. Before the skin incision.
3. At the most traumatic stage of the operation (extraction of the fetus, revision of the abdominal cavity).
4. After the operation is completed.

*Table 1*

*Some indicators characterizing the function of external respiration and SpO<sub>2</sub> at the stages of anesthesia and surgery in pregnant women with “moderate” stenosis of the atrioventricular orifice (2,9-2 cm<sup>2</sup>)*

Parameters studied	Groups	Research stages				
		BH, per minute	BV, ml/kg	MOD, l	MLV, l/min	SpO <sub>2</sub> , %
On the operating table	1	22,7±0,5	0,54±0,03	12,3±0,4	43,8±1,9	92,8±1,3
	2	23,1±0,4	0,53±0,05	12,2±0,5	42,9±2,5	92,9±1,2
	3	22,9±0,5	0,51±0,03	11,9±0,6	43,2±2,1	93,1±1,4
Before the skin incision	1	19,8±0,3©	0,49±0,03	9,7±0,4 ©	38,6±2,1 ©	92,6±1,1
	2	20,1±0,3 ©	0,53±0,03	10,9±0,4 ©	40,1±2,0	92,4±1,4
	3	20,9±0,4 ©	0,54±0,05	11,2±0,6	41,4±2,3	92,5±1,2
Traumatic stage	1	21,8±0,3 Δ	0,49±0,03	10,8±0,5	-	93,2±0,9
	2	22,6±0,4 Δ	0,51±0,03	11,4±0,6	-	93,8±1,1
	3	23,1±0,5 Δ	0,49±0,04	11,3±0,4	-	93,6±1,2
End of operation	1	20,2±0,4	0,55±0,02 Δ	11,2±0,4	43,9±2,1	94,3±1,3
	2	21,8±0,3	0,59±0,03 Δ	12,6±0,6	43,2±2,3	94,2±1,2
	3	21,3±0,4	0,61±0,04 © Δ	12,8±0,4	42,6±3,1	94,8±1,1
After 24 hour	1	20,6±0,5 ©	0,62±0,03 ©	12,8±0,5	48,8±2,0 © Δ	95,1±1,2
	2	19,8±0,3 ©	0,63±0,04 ©	12,5±0,6	48,1±2,1 © Δ	95,3±1,3
	3	20,1±0,4 ©	0,61±0,03 ©	12,3±0,6	48,4±1,9 © Δ	95,2±1,3

© indicates statistical significance of differences ( $p < 0.05$ ) compared to the original data; Δ – indicates the statistical significance of the differences ( $p < 0.05$ ) compared to the previous stage of the study; ● – indicates statistical significance of the differences ( $p < 0.05$ ) between the 3rd and 4th study groups; □ - indicates statistical significance of differences in comparison with group 5

*Note:* Thus, the variants of central blockades used in our study do not have a significant depressive effect on the function of external respiration and gas exchange. It is important to note

that when using spinal anesthesia (SA) at the level of the segmental sensory-motor block, moderate depression of the respiratory function may occur, requiring correction.

All obtained numerical values were processed by methods of variation statistics using Student's t-test using Microsoft Excel and presented in the form  $M \pm m$ , where  $M$  is the arithmetic mean,  $m$  is the standard error of the mean. Differences were considered statistically significant at  $p < 0.05$ . The results are presented in Table 3.

**Results and discussion.** Characterizing the clinical course of spinal anesthesia (SA) in group I, it is noted that the classic signs of complete segmental sensory-motor block developed by the 6-8th minute from the moment of subarachnoid injection of the calculated dose of local anesthetic and persisted for 1.5-2 hours. In this case, the segmental level of sensory blockade corresponded to Th5-Th6 dermatomes. When using variants of epidural anesthesia (2-3 groups), signs of a complete segmental sensory-motor block were formed by the 15-18th minute, the segmental level of sensory blockade corresponded to Th7-Th9 dermatomes, the duration of the surgical stage of epidural anesthesia was 1.5-2 hours. It should be noted that in patients of group III, 8-10 minutes after the epidural administration of anesthetic solutions, a pronounced sedative effect was observed, probably due to the systemic effect of fentanyl, which made it possible to subsequently refuse the administration of benzodiazepines. Throughout the entire operation, including its most traumatic stages, patients of all three study groups did not react, did not express complaints, and no additional pain relief was required. There were no signs of respiratory depression. However, the absolute SpO<sub>2</sub> values did not exceed 94-96%, which required periodic oxygen inhalation. The initial state of hemodynamics in all three study groups was maintained in a hypodynamic type of blood circulation. There was pronounced tachycardia, a significant decrease, relative to the proper values, of one-time and minute cardiac output. Systolic diastolic pressure (SDP) and total peripheral vascular resistance (TPVR) were elevated, and minute diuresis corresponded to the lower limits of its physiological fluctuations (see Table 1). There were no group differences in the studied indicators. Against this background, a fairly pronounced activation of the sympathetic part of the autonomic nervous system (ANS) was noted, but it did not go beyond the limits of physiological fluctuations (tension index was  $336.4 \pm 20.6 - 349.4 \pm 35.7$  conventional units). The predominance of a negative balance in the activity of the sympathetic department is associated with pregnancy, a decrease in coronary reserves and circulatory failure, which have a negative impact on the main life support systems of parturient women. The concentration of total cortisol (TC) in the blood plasma and the rate of excretion of norepinephrine (NA) in the urine were also increased compared with data in patients with a normal pregnancy at 34-36 weeks. There were no significant intergroup differences in the studied indicators. Before the skin incision against the background of a complete segmental block, patients of all three groups showed classic clinical and functional manifestations of central segmental blocks - a decrease in heart rate (HR), a decrease in SDP and TPVR (see Table 1), which was significantly more pronounced when using spinal anesthesia. Thus, the MDD and TPR in group I of patients decreased by 28.9% and 17.2%, respectively, and heart rate by 11.4%. This required vasopressor support. Against this background, the cardiac output index (CI) significantly decreased from  $2.43 \pm 0.04$  l/m<sup>2</sup>/min to  $1.97 \pm 0.06$  l/m<sup>2</sup>/min. At the same time, in patients of group II, changes in the studied hemodynamic parameters were not as pronounced. SDP and TPR decreased only by 16.4% and 10.3%, respectively, and HR decreased by 6.4%. SI tended to decrease and amounted to  $2.28 \pm 0.09$

l/m<sup>2</sup>/min. In patients of group III, minimal hemodynamic changes were observed. SDP and TPR decreased only by 9.1% and 4.8%, heart rate decreased by 2.7%. SI was 2.72 ± 0.09 L/m<sup>2</sup>/min.

**Table 2**

***Some indicators of hemodynamics and peripheral circulation at the stages of anesthesia and surgery in patients with moderately severe MC (2,9-2 cm<sup>2</sup>)***

Stages of research	Parameters studied					
	groups	HR per min	SDP, mm.r	HI, l/m <sup>2</sup> /min	TPVR din/c×m <sup>-5</sup>	Minute diuresis, ml/min
On the operating table	1	98,8±1,2	87,8±3,2	2,34±0,04	1806,1±60,4	0,52±0,02
	2	97,6±1,8	86,8±4,1	2,42±0,07	1796,4±58,4	0,54±0,04
	3	98,5±1,8	85,9±3,1	2,43±0,05	1788,0±60,1	0,54±0,02
Before the skin incision	1	87,5±1,1*Δ	62,4±2,6** □	1,9±0,06*Δ □	1495,5±70,6*Δ	0,19±0,01* Δ□
	2	91,4±1,2*Δ	72,6±1,9*Δ □	2,13±0,05* Δ	1612,1±64,4*	0,32±0,01* Δ□
	3	95,9±1,4	78,1±1,8*	2,28±0,09*	1703±58,4	0,41±0,01*
Traumatic stage	1	104,4±2,3* **□	72,9±2,1** *	2,12±0,09* **	1769,9±82,3**	0,26±0,01* **Δ□
	2	101,2±1,2* *	75,8±2,2*	2,2±0,07*	1714,5±67,4	0,39±0,01* **Δ□
	3	100,3±1,8	80,2±1,6	2,3±0,06	1713,2±60,9	0,47±0,02* **□
End of operation	1	98,1±2,1**	76,4±2,1*	2,21±0,05* Δ	1720,3±54,6	0,42±0,03* **
	2	96,2±2,1**	76,9±2,0*	2,38±0,06Δ **	1615±58,1 *	0,51±0,04* *
	3	94,1±1,9**	78,6±2,4	2,45±0,08	1604±56,6 *	0,59±0,03* *

Note:

\* - differences, statistically significant (p<0.05), compared with the initial preoperative values;  
 \*\* - differences, statistically significant (p<0.05), compared with the previous stage of the study;

$\Delta$  - differences, statistically significant ( $p < 0.05$ ), between groups I and II;  $\square$  - differences, statistically significant ( $p < 0.05$ ), in comparison with group III.

It should be noted that in the 1st group of patients, vasopressor support was required in 100% of cases, in the 2nd group - only in 6 (42.8%), and in the 3rd group - in only 2 women (11.7%).

Before the operation, against the background of complete segmental sensory-motor and sympathetic blockade, there was a significant decrease in the tension index in patients of group 1 by 31.8%, which indicates a decrease in the sympathetic influence and the degree of tension in the heart rate regulation systems. At the same time, the concentration of cortisol in the blood plasma increased by 53.1%, indicating a suitable protective reaction of the hypothalamic-pituitary-adrenal system to changes in hemodynamics and a decrease in sympathetic influence.

At this stage, in patients of the 2nd and 3rd groups, the voltage index decreased only slightly, amounting to  $298.2 \pm 20.2$  conventional units and  $218.4 \pm 20.5$  conventional units, respectively. While the concentration of cortisol in the blood plasma increased significantly by 42% (in the 2nd group) and 33.5% (in the 3rd group). At the most traumatic stages of the operation, there were no significant changes in the studied hemodynamic parameters compared to the previous stage in all three groups (see Table 2).

The stress index increased in all three groups relative to the initial preoperative values and the previous stage of the study, reaching  $446.4 \pm 21.6$  conventional units,  $450.2 \pm 23.4$  conventional units and  $490.8 \pm 24.3$  conventional units, respectively. The concentration of cortisol in the blood plasma also increased, reaching  $743.3 \pm 38.4$  nmol/l in patients of group 1,  $687.2 \pm 36.1$  nmol/l in patients of group 2 and  $677.6 \pm 37.4$  nmol/l in group 3. It should be noted that in each of the three study groups, the studied parameters remained within the "stress norm", which confirms the adequacy of pain relief.

Completion of the operation was accompanied by a tendency toward normalization of the studied hemodynamic parameters (see Table 2), but the hypodynamic nature of the blood circulation remained.

**Table 3**

***Some indicators of the autonomic, sympathoadrenal and hypothalamic-pituitary-adrenocortical systems at the stages of anesthesia and surgery in patients with moderately severe MS (2,9-2 cm<sup>2</sup>)***

Parameters studied	groups	Stages of research			
		On the operating table	Before the skin incision	Traumatic stage	End of operation
Ind. Piec.	1	336,4±20,6	229,4±208** $\Delta$	446,4±21,6 $\Delta$	416,1±22,3*
	2	349,6±18,6	289,2±20,2**	450,2±23,4 $\Delta$	410,3±21,3*
	3	339,4±23,1	302,1±20,5	490,8±24,3* $\Delta$	396,6±20,2*
SC, nmol/l	1	410,8±26,4	628,2±26,1* $\square$	734,3±38,4 $\Delta$	691,5±29,3 $\square$

	2	402,3±38,4	582,7±32,5*	687,2±36,1*Δ	627,4±30,6*
	3	390,5±34,3	521,4±30,8*	677,6±37,4*Δ	601,4±32,6*
NA, nmol/l (urine)	1	8,9±1,2	-	-	13,1±1,1*
	2	9,1±1,1	-	-	12,5±1,3*
	3	8,8±1,2	-	-	12,3±1,3*

*Note: \*-statistically significant differences ( $p < 0.05$ ) relative to the initial values; Δ- statistically significant differences ( $p < 0.05$ ) relative to the previous stage of the study; \*\*- statistically significant differences ( $p < 0.05$ ) between groups I and II; □- statistically significant differences ( $p < 0.05$ ) relative to group III;*

The data presented above indicate moderate activation of the sympatho-adrenal, hypothalamic-pituitary-adrenocortical and hypothalamic-pituitary-adrenocortical systems in response to surgical trauma, confirming the effectiveness of the used versions of central neuroblockades. Summarizing the above, we can conclude that among the methods of central neuroblockade used, epidural anesthesia with reduced concentrations of bupivacaine (0.375%) in combination with fentanyl (1.4 mcg/kg) should be considered the safest and most effective in antinociception due to its minimal impact on basic life support systems.

#### **Conclusions:**

1. The best method of anesthetic management for cesarean section in patients with a moderate decrease in coronary reserves at 34-36 weeks of pregnancy is balanced epidural anesthesia using reduced concentrations of 0.375% bupivacaine in combination with fentanyl (1.4 mcg/kg) and preliminary analgesia 100 ml of 1% paracetamol solution.

2. This method is highly effective, has minimal impact on central hemodynamics and provides the possibility of long-term postoperative pain relief.

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