https://doi.org/10.23934/2223-9022-2020-9-2-221-230

The Choice of Anesthesia During Organ-Saving Operations Concerning Patients with Placenta Accreta Spectrum Disorders

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ABSTRACT Placenta accreta (PAS-disorders) is one of the most serious complications of pregnancy, associated with the risk of massive uterine bleeding, massive hemotransfusion and maternal mortality. Peripartum hysterectomy is a common treatment strategy for patients with placenta accreta. Currently, there is a clear trend of changing surgical tactics in favor of organ-saving operations, but there are no studies devoted to anesthesiological support of such operations.

THE AIM OF THE STUDY is to substantiate an effective and safe method of anaesthesia in organ-saving operations for placenta accreta spectrum disorders.

MATERIAL AND METHODS The study involved 80 patients with a diagnosis of placenta accreta spectrum disorders, confirmed intraoperatively, who underwent organ-saving operations. The patients were randomized depending on the method of anesthesia into 3 groups: general anesthesia, spinal anesthesia with planned conversion to general after fetal extraction and epidural anesthesia with planned conversion to general also after fetal extraction. The comparison of intraoperative hemodynamics, efficiency of tissue perfusion, efficiency of antinociceptive protection at the stages of surgery was performed. A comparative analysis of the volume of blood loss and blood transfusion, time of patients activation in the postoperative period, severity of pain on the first day after surgery, duration of hospital stay before discharge and comparison of the assessment of the newborn according to Apgar score at first and fifth minute after extraction.

CONCLUSION The study shows that the optimal method of anesthesia in organ-saving operations for placenta accreta spectrum disorders is epidural anesthesia with its planned conversion to general anesthesia with an artificial lung ventilation after fetal extraction. Such an approach to anesthesia allows to maintain stable hemodynamic profile with minimal vasopressor support, sufficient heart performance, providing effective tissue perfusion and a high level of antinociceptive protection at the intraoperative stage and reduce the volume of intraoperative blood loss and hemotransfusion. In the current study there were no differences in neonatal outcomes and duration of hospitalization depending on the method of anesthesia. The advantage of epidural anesthesia with its conversion to general anesthesia was earlier activation after surgery and lower intensity of postoperative pain syndrome.

Keywords: placenta accreta spectrum disorders, organ-saving operations, general anesthesia, epidural anesthesia, spinal anesthesia

For citation Plakhotina EN, Belousova TN, Kulikov IA, Latyshev RV, Pavlyutina KM. The Choice of Anesthesia During Organ-Saving Operations Concerning Patients With Placenta Accreta Spectrum Disorders. *Russian Sklifosovsky Journal of Emergency Medical Care.* 2020;9(2):221–230. https://doi.org/10.23934/2223-9022-2020-9-2-221-230 (in Russ.)

Conflict of interest Authors declare lack of the conflicts of interests

Acknowledgments, sponsorship The study had no sponsorship

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ALV – artificial lung ventilation
BP – blood pressure
BW – body weight
CBV – circulating blood volume
EA – epidural anesthesia
GA – general anesthesia
MBP – mean arterial pressure
NSAIDs – nonsteroidal anti-inflammatory drugs
SA – subarachnoid anesthesia
VAS – visual analogue scale

INTRODUCTION

Placenta accrete *(PAS-disorders)* is one of the most serious complications of pregnancy, associated with the risk of massive uterine bleeding, massive blood transfusion and maternal mortality. For the last decade there has been an increase in the frequency of this complication. Placenta accreta is diagnosed in every 500th pregnancy [1, 2]. Mortality during the development of this complication reaches 7% [3, 4] and is due, first of all, massive blood loss and blood transfusions. Problems, associated with operative delivery patients with placenta accrete, are widely discussed in the world literature [5-9]. In 2018, International Federation of Obstetricians and Gynecologists *(FIGO)* published recommendations by non-conservative treatment of patients with placenta accreta [10]. These recommendations formulated a modern view at the approaches to the treatment of this pathology, based on the analysis of the results of observational studies, experience of some centers and the opinion of experts. The part, dedicated to the anesthesia for such operations, shows the absence of general opinion on the choice of anesthesia. Publications on this topic show the absence of a unified approach to anesthesia [11-16]. Results of the survey of 26 different Israeli perinatal centers have shown, that the majority of anesthesiologists perform general anesthesia (GA) when suspecting *PAS-disorders* [17]. On the other hand, more cases of regional methods of anesthesia are reported, traditional in obstetrics. Epidural (EA), subarachnoid anesthesia (CA) and their combination are performed [18, 19]. However, there are quite a lot of reports on the urgent switch to GA during the development of massive blood loss, hypovolemic shock and hypoxia [11, 13, 14]. Some researchers have reported a decrease in the volume of blood loss and the need in the components of the donor blood for operations on *PAS-disorders* in terms of regional anesthesia as compared to GA [20, 21]. Others show no dependence between the amount of blood loss and hemotransfusion and method of anesthesia [12]. An important point, when planning anesthesia in patients with placenta accreta, is the lack of influence on neonatal outcomes of regional anesthesia [12].

It is necessary to note, that there are no large randomized studies, relating to the approaches to the treatment of patients with placenta accreta. This is associated with the specificity of this pathology. There is a distinct trend of changing surgical tactics in favor of organ-saving operations [22-25]. There are no researches, concerning anesthesia in organ-saving operations, as all the world's guideline the strict recommendation is implementation of peripartum hysterectomy when diagnosing *PAS-disorders* [10].

The aim of study is to evaluate the effectiveness of different options for anesthesia and to develop unified approach to the anesthesia in organ-saving operations in patients with placenta accreta.

Research objectives:

1. To carry out a comparative analysis of intraoperative hemodynamics in terms of different ways of anesthetic manuals during routine organ operations for placenta accreta.

2. To rate the volume of intraoperative hemorrhage and infusion - transfusion therapy.

4. To analyze postoperative period after organ-saving operations and compare the evaluation condition of the newborn after various types of anesthesia.

MATERIAL AND METHODS

The research was conducted in 2014-2019 at Vidnovsky Perinatal Center. For comparison, prospective randomized study of the effectiveness and safety of different methods of SA prior to extraction the fetus with subsequent planned switch to GA with ventilator (group 2, "SA + GA"). The third group included patients, where EA with subsequent transition in GA with ventilator (group 3, "EA + GA"). The choice of anesthesia was defined by the analysis of publications on this topic and experiences of application of such anesthesia in the world practice [11, 13, 17].

The criteria for inclusion in the study were: installed on the preoperative stage diagnosis of "high risk of placenta accreta" with subsequent clinical and histological confirmation of the diagnosis of "placenta accreta", operative delivery is in a planned manner, the absence of bleeding prior to surgery, the absence of serious comorbidities, written consent of the patient to participate in the study and select of anesthesia. Exclusion criteria were implementation of the extirpation of the uterus and the absence of histological confirmation of infection of the placenta. The distribution of patients of groups was performed with the use of the method of generation of random numbers (program *Microsoft Excel* 2010). All patients underwent organ-saving operation according to the established procedure: lower midline laparotomy curved to the left of the umbilicus, fundal caesarean section, metroplasty with uterine tourniquets and vaginal module of the Zhukovsky balloon. Preoperative preparation included autoplasma in amount 15-30% of circulating blood volume (CBV) in several stages from 26 to 34- th week of pregnancy.

The reinfusion of washed red blood cells was performed intraoperatively.

During the recruitment of groups, 10 patients were excluded from the study. From group 1 - 7 patients and from group 2 - 3 patients. Three patients from group 1 and 2 - from group 2 were excluded from the study due to peripartum hysterectomy. After checking the data on the availability of doubtful cases 4 patients were excluded from group 1, and one patient was excluded from group 2, who underwent resection of urinary bladder intraoperatively. Due to the small number of groups and uneven distribution of this trait in the studied groups, these patients were regarded as a "pull-down options", not dependent on the type of anesthesia, capable of distorting the results of the study. Nobody was excluded from group 3.

In group 1 (GA) propofol in amount of 2-2.5 mg / kg of body weight (BW), and fentanyl, 0.6-0.7 mcg / kg were used for induction of anesthesia. Endotracheal intubation was performed on the background introduction rocuronium, 1 mg / kg BW, which was further prolonged on demand fractionally by 20 mg. After the delivery inhalation with Sevorane in a minimum concentration for maintaining bispectral index in the range of 40-60 was initiated. The average concentration of Sevorane was 0.9 ± 0.2 vol %. Analgesia was maintained by dosed infusion of a combination of 0.05 μg / kg / min fentanyl and 10 μg / kg / min ketamine. In group 2 (SA + GA) SA prior to the operation delivery was provided by a single administration of bupivacaine, 12.5 mg in the subarachnoid space at the level of L3-4 (L2-3), with a subsequent switch to GA. Induction, intubation, myorelaxation and maintenance of anesthesia was performed by the procedure, similar to that in group 1. Additional analgesic component in this group ensured dosage infusion of fentanyl 0.025 mg / kg / min. In group 3 (EA + GA) before operation on level L1-2 (L2-3) epidural catheter was installed. The epidural block before the delivery was provided by the introduction of ropivacaine, 0.5% - 25-30 ml (125-150 mg) into the epidural space. Later there was a switch to GA according to the described procedure. Additional analgesic component was performed by dosage infusion of fentanyl 0.025 mg / kg / min. In this group after reaching surgical

haemostasis with the aim of extending the analgesic effect bolus ropivacaine 0.1% - 20 ml (20 mg) was administered in the epidural space. Patients of all groups had vasopressor support with fractional administration of phenylephrine with subsequent calculation of amount used. In case of massive bleeding Sevorane inhalation was canceled, and hypnotic component of anesthesia provided was provided by bolus introduction of hydroxybutyrate sodium 40-50 mg / kg BW. There were no between-group differences in the frequency of the transition from inhalation to total intravenous anesthesia. Tracheal extubation was performed in patients of all groups on the operating table by 30 ± 1 3 minutes after the end of operation and standard observation in terms of the operating room. Before extubation, index of oxygenation, indicators of hemoglobin, hematocrit number and condition of hemostasis at the results thromboelastography were evaluated.

For invasive assessment and hemodynamics, radial artery catheterization was performed. Continuous invasive monitoring hemodynamic evaluated systolic, diastolic, mean arterial pressure (MBP) and the heart rate (HR). Cardiac output and cardiac index were calculated automatically on the basis of the patented technique *Nihon Kohden*, taking into account the parameters of the pulse waves, electrocardiograms and dynamics of blood pressure (BP) during each subsequent cardiac cycle. Given the probability of errors of calculation of the central hemodynamics parameters, not absolute values were evaluated, but the dynamics of these indicators during anesthesia. Comparative intergroup analysis of the obtained data was carried out by the following stages: 1 st stage - before anesthesia, 2 nd stage - 5 minutes after initiation of anesthesia, 3 rd stage - after the delivery, 4 th stage - metroplasty, 5 th stage - surgical pause and 6 th stage – ending of operation. The total need in vasopressor support was evaluated before and after the delivery.

Comparative analysis of the performance efficiency of tissue perfusion: the concentration of lactate in the arterial blood and the oxygen saturation of hemoglobin with oxygen central venous blood conducted in the following steps : 1 st stage – the beginning of operation, 2 nd stage - metroplasty, 3 nd stage - surgical pause, 4 th stage - before extubation.

The effectiveness of antinociceptive protection was assessed by the dynamics of the level of cortisolemia at three stages: 1 - before the operation, 2 - the stage of metroplasty, 3 - the end of the operation.

The comparative analysis of volumes intraoperative blood loss, infusion - transfusion therapy, timing of activation of the patients in the postoperative period (time interval between the receipt of a chamber of intensive therapy and ability d Vigano in within chamber), the severity of the pain syndrome according to visual analog scale (VAS) on the first day after operation (after 5, 10, 20 hours after the end of surgery) and the duration of stay in hospital prior to discharge were assessed. With the aim of identifying possible effect of anesthesia on a newborn, intergroup comparisons of scale Apgar at 1 minutes and 5 minutes after the delivery was peformed.

Statistical analysis of the research results was carried out using the *Statistica* 10 software (*StatSoft Inc.*, USA). The distribution was not tested for normality in the studied groups. Descriptive statistics is presented in the form of the median (M), 25% and 75% percentiles (P 25 and P 75). For comparisons we used non-parametric criteria. The *Kruskal-Wallis-test was* used for intergroup comparison of the three groups. *Mann-Whitney u-test* was used to compare the quantitative data in two unrelated groups. For comparison of quantitative data in related groups *Freidman-test* and the *Wilcoxon-test* were used. Differences were considered statistically significant at the level of a criterion of significance less than 0.05.

RESULTS

Compared group did not differ according to age, timing of delivery and parity (Table 1).

Table 1

Representativeness of groups (Kruskal–Wallis test) for various types of anesthesia

Parameters M (P_{25}; P_{75})	Groups			*R*
	Group 1 GA, *n*=23	Group 2 SA + GA, *n*=27	Group 3 EA + GA, *n*=30	
Age, years	36 (33; 39)	35.5 (32; 40)	35 (31.2; 39)	0.432
BMI, kg/m $^{-2}$	28.4 (26.8; 30.4)	27.6 (27.1; 29.9)	27.8 (26.3; 30.1)	0.755
Term of delivery, weeks.	37 (36; 37)	37 (35; 37)	37 (35; 37)	0.348
Parity of childbirth, n	3 (2; 3)	3 (2; 3)	3 (2, 3.75)	0.811
Duration of operations, min	129 (105; 157)	112 (98; 155)	109 (94.7; 143)	0.072
Amount of prepared autoplasma, ml	1500 (1000; 1550)	1500 (1000; 2000)	1500 (650; 2000)	0.881

Notes: BMI — body mass index; EA — epidural anesthesia; GA — general anesthesia; M — median; SA — spinal anesthesia

There were no intergroup differences in the amount of prepared autoplasma (see Table 1). It should be noted, that of - for various terms identifying placenta invasion, and proceeds and admission to hospital for surgery autoplasma wasn't prepared in all cases in a volume of 1000–2000 ml. For example, in group 3 (EA + GA), autoplasma preparation was performed in 83% of cases and only in 70% - in a volume of 1000–2000 ml (Table 2).

Table 2

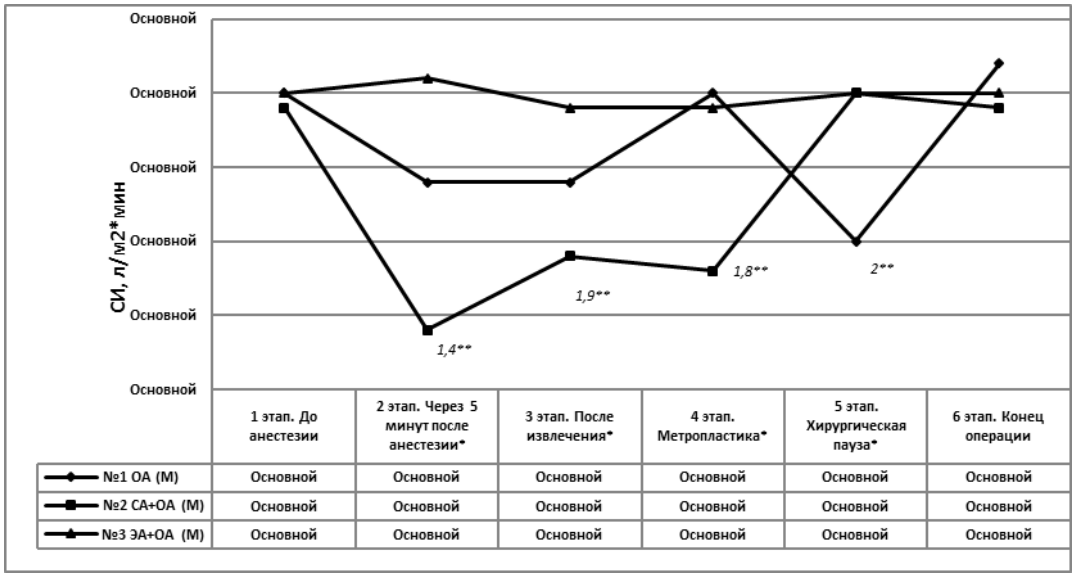
Intergroup distribution of prepared autoplasma volumes

Groups	The volume of prepared autoplasma before surgery, ml				
	No	500	1000	1500	2000
Group 1 GA, n=23	0	4	8	6	5
Group 2 SA + GA, n=27	0	0	14	0	13
Group 3 EA + GA, n=30	5	3	6	9	7

Notes: EA — epidural anesthesia; GA — general anesthesia; SA — spinal anesthesia

As you seen in the Table 2, in groups 1 and 2 autoplasma was prepared in all patients, but in different amounts. In group 2, 1000 - 2000 ml were prepared in 100% of cases, and in group 1 - only in 82% of cases. The indications for transfusion of autologous plasma were coagulation disorders, confirmed thromboelastography. Unused autoplasma was disposed.

The study of hemodynamic characteristics of given types of anesthesia showed, that the greatest changes in the cardiac index during anesthesia and surgery were observed in group 2 (combination of SA and GA). In this group, over 5 minutes from the start of anesthesia the index significantly decreased, and remained the same at all subsequent stages up to the stage of the surgical pause. The cardiac index in this group returned to the initial level only at the end of the operation (Fig. 1).



	1 этап. До анестезии	2 этап. Через 5 минут после анестезии*	3 этап. После извлечения*	4 этап. Метропластика*	5 этап. Хирургическая пауза*	6 этап. Конец операции
№1 ОА (М)	Основной	Основной	Основной	Основной	Основной	Основной
№2 СА+ОА (М)	Основной	Основной	Основной	Основной	Основной	Основной
№3 ЭА+ОА (М)	Основной	Основной	Основной	Основной	Основной	Основной

Fig. 1. The comparative analysis of the dynamics of the cardiac index at the stages of the operation (Kruskal-Wallis test *, Mann-Whitney U-test **) depending on the type of anesthesia

Notes: CI — cardiac index; EA — epidural anesthesia; GA — general anesthesia; SA — spinal anesthesia

In group 1 (GA) more stable cardiac index during the surgery was observed. Its statistically significant decrease was noted at two stages - after the delivery and during the surgical pause. In group 3 (combination of EA and GA), in contrast to the other two groups, the cardiac index remained stable at all stages.

Mean arterial pressure decreased in all groups 5 minutes after the start of anesthesia, except group 1 (Fig. 2).

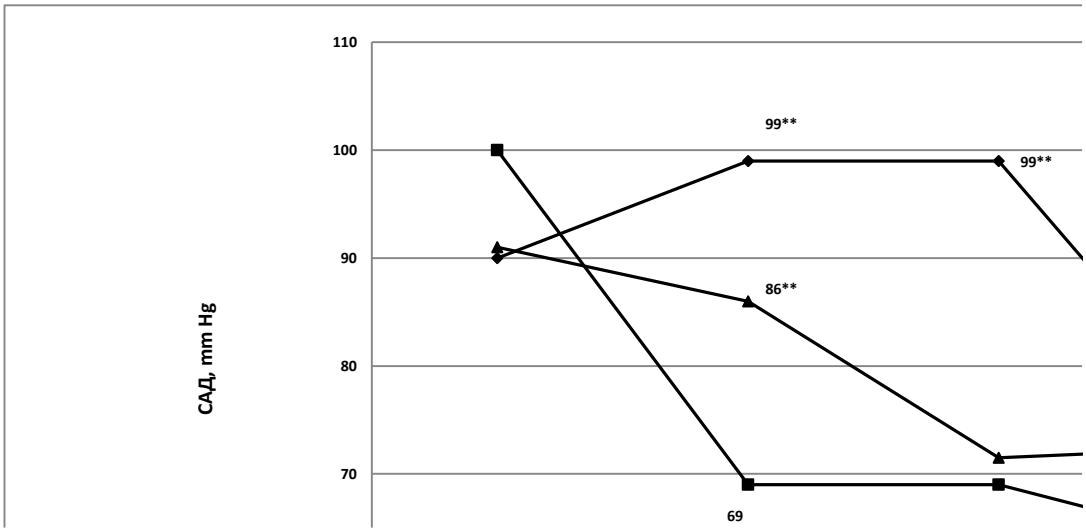


Fig. 2. The comparative analysis of the dynamics of mean arterial blood pressure at the stages of the operation (Kruskal-Wallis test *, Mann-Whitney U-test, depending on the type of anesthesia

Notes: EA — epidural anesthesia; GA — general anesthesia; MBP — mean blood pressure; SA — spinal anesthesia

It is necessary to note, that, as seen on Fig. 2, 2 nd stage in group 1 often coincided with 3 rd stage (the delivery). After fetal extraction in group 2, this indicator continued to decline until the stage of metroplasty. At the time of surgical pause when reaching surgical haemostasis SBP only in group 3 statistically significantly did not differ from preoperative level, while in two other groups this figure remained significantly below baseline values. At the end of the operation, in the GA group, the trend towards a decrease in SBP persisted, which required the continuation of vasopressor support.

More stable hemodynamics in group 3 in contrast to two other groups is confirmed with lower need for vasopressor support during the operation (Table 3).

Table 3

Comparison of the need for vasopressor support at the stages of the operation (phenylephrine, fractional administration, mg), M (P25; P75) depending on the type of anesthesia

Operation stages	Groups			*p, Kruskal-Wallis test*
	Group 1 GA, *n*=23	Group 2 SA + GA, *n*=27	Group 3 EA + GA, *n*=30	
Before fetal extraction	0	0.6 (0.2; 0.8) *	0	0.001
After fetal extraction	1.2 (0.8; 2.2)	2.1 (0.6; 2.9)	0.8 (0.2; 0.8) *	0,031

Notes: * — p < 0.05, Mann-Whitney U-test; EA — epidural anesthesia; GA — general anesthesia; SA — spinal anesthesia

At study concentration lactate arterial blood revealed significant its increase in group 2 in comparison with the initial value. On the main stages of the operation level of lactate in this group was higher, than in the two other (Fig. 3).

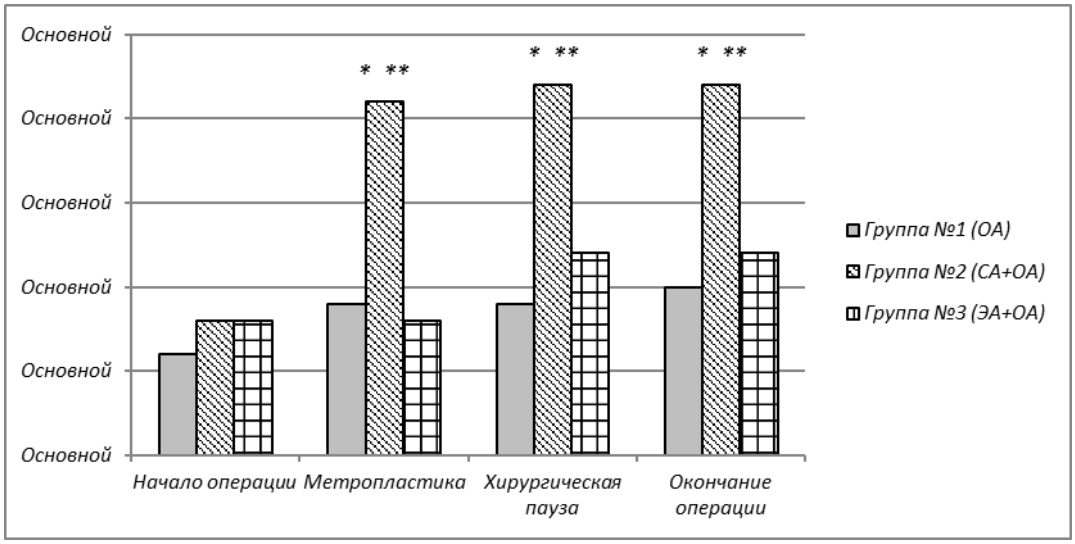


Fig. 3. The dynamics of the lactate concentration (mmol/L) of arterial blood at the stages of the operation (Wilcoxon test *, Mann–Whitney U-test **) depending on the type of anesthesia

Notes: EA — epidural anesthesia; GA — general anesthesia; SA — spinal anesthesia

You must also be noted, that the concentration of lactate arterial blood in all groups did not come out of the limits of the reference values.

Central venous blood saturation values remained stable at the stages of surgery. There were no statistically significant differences at intergroup and intragroup comparison (Fig. 4).

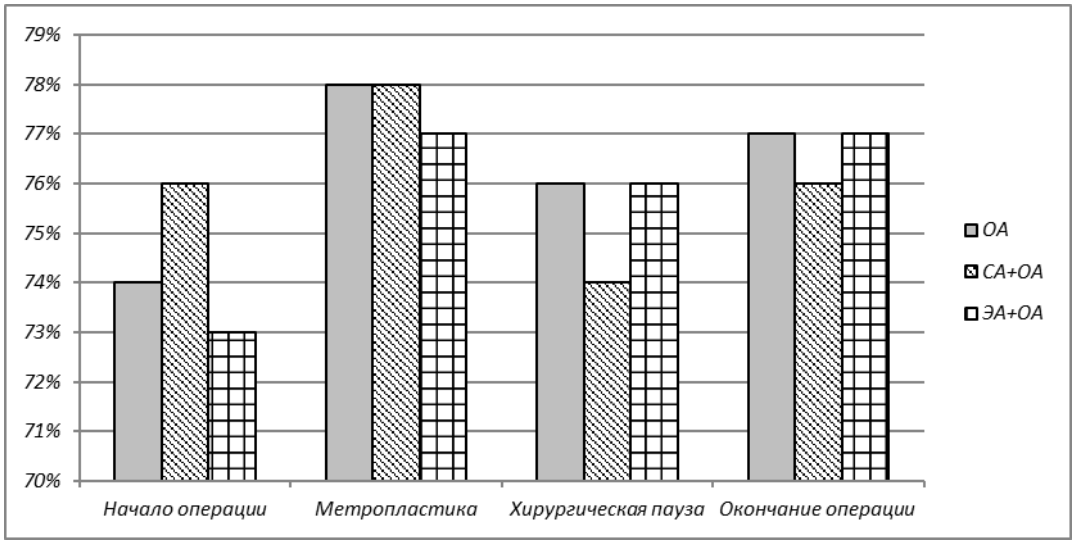


Fig. 4. The dynamics of saturation of central venous blood at the stages of the operation (Kruskal-Wallis test, Friedman test, p > 0.05) depending on the type of anesthsia

Notes: EA — epidural anesthesia; GA — general anesthesia; SA — spinal anesthesia

When assessing efficiency of antinociceptive protection in conditions of various types of anesthesia a significant increase in the concentration of cortisol in the blood at the main stage of operation was observed in group 1 (GA), which persisted by end the operation. In group 2 (SA + GA), the level of cortisol increased significantly only by the end of the operation (Table 4).

Table 4

The dynamics of the concentration of cortisol in the blood at the stages of the operation, depending on the type of anesthesia, nmol/L (Norm <536 nmol/L), M (P25; P75)

Groups	Research stages			p, Freidman test
	Before the cut	Metroplasty	End of operation	
Group 1 GA, n=23	671.5 (586; 786)	1112 (889; 1167) *	1066.5 (997; 1184) *	0.001
Group 2 SA + GA, n=27	576 (483; 786)	802 (673; 956)	951 (836; 1080) *	0.004
Group 3 EA + GA, n=30	753 (593; 762)	869 (786; 1018)	623 (378; 779) **	0.32
p, Kruskal-Wallis test	0.146	0.51	0.017	

Notes: * — Wilcoxon test; ** — Mann - Whitney U-test; EA — epidural anesthesia; GA — general anesthesia; SA — spinal anesthesia

In group 3 (EA + GA) concentrations of cortisol remained stable during the operation and by the end of the surgery it was significantly lower, than in the two other groups.

Concerning intraoperative blood loss it should be noted, that it was statistically significantly greater in group 1, than in the two other groups (Table 5), which resulted in an increase in the volume of blood transfusion components of the donor blood and the volume of infusion - transfusion therapy compared to the other two groups.

Table 5

Comparative analysis of intraoperative blood loss and infusion-transfusion therapy (Kruskal–Wallis test) depending on the type of anesthesia

Indicator M (P25; P75)	Groups			R
	Group 1 GA, n=23	Group 2 SA + GA, n=27	Group 3 EA + GA, n=30	
Blood loss, ml	4916 (4312.5; 5704.6) *	3320 (3125; 4000)	2662 (1142.7; 4261.3)	0.0016
Blood loss,% CBV	53 (47.7; 67.7)	41.5 (33.4; 54.8)	38.1 (15.2; 62.5)	0,081
ITT, ml	7572.5 (5735; 9508.7)	5025 (4231.3; 6025)	4425 (2937.5; 6204.4) *	0.04
Reinfusion of red blood cells, ml	1612.5 (970.6; 2710.6) *	767 (612.5; 1,003.7)	750 (260.5; 1046.9)	0.008
Donor volume erythro suspension , ml	580 (281.7; 1427.5) *	0 (0; 857.5)	0 (0; 626.3)	0.012
Donor volume QFFP, ml	935 (524; 1200)	680 (425; 1300)	213 (0; 569.7) *	0.0002
Auto FFP, ml	1500 (1000; 1550)	1000 (1000; 2000)	1500 (890.6; 2000)	0.214
Colloids, ml	0 (0; 500)	0 *	0 (0; 500)	0.0007
Crystalloids, ml	1500 (1437.5; 1712.5)	1500 (1500; 1657.5)	1500 (1500; 2000)	0.636

Notes: * p < 0.05, Mann-Whitney U-test; EA — epidural anesthesia; FFP — fresh-frozen plazma; GA — general anesthesia; ITT — infusion-transfusion therapy; SA — spinal anesthesia; QFFP — quarantine fresh-frozen plasma

In group 3 (EA + GA), intraoperative blood loss was replenished only by autoblood components in 17 patients (57%), in group 2 (CA + GA) there were 8 such patients (30%), and in group 1 (GA) - 3 (13 %).

In the early postoperative period patients in group 1 (GA) and 3 (EA + GA) were activated by 246 (186; 312) minutes and 276 (204; 366) minutes, respectively, which is significantly faster, than in group 2 (SA + GA), where activation of the patients became possible only through 384 (198; 454) minutes after the end of operation. Probably, a more prolonged period, required for activation of patients in group 2 was associated with severe postoperative pain syndrome, which is estimated by a simple 10-point VAS upon activation (Table 6).

Table 6

The dynamics of the severity of postoperative pain syndrome (VAS), M (P25; P75) depending on the type of anesthesia

Groups	Research stages			p, Freidman test
	5 hours after the end of the operation	10 hours after the end of the operation	20 hours after the end of the operation	
Group 1 GA, n=23	4 (3; 7)	5 (3; 6)	5 (3; 7)	0.215
Group 2 SA + GA, n=27	6 (4; 8) * , **	4 (3; 7)	4 (2; 7)	0,047
Group 3 EA + GA, n=30	3 (2; 4)	3 (2; 6)	2 (1; 5) **	0.32
p, Kruskal-Wallis test	0.032	0.51	0.017	

Notes: * — Wilcoxon test; ** — Mann-Whitney U-test; EA — epidural anesthesia; GA — general anesthesia; SA — spinal anesthesia; VAS — visual analogue scale

In the early postoperative period, patients of all groups received planned analgesia: a combination of nonsteroidal anti-inflammatory drugs (NSAIDs) and paracetamol. If pain syndrome was significant, narcotic analgesics were prescribed. All patients of group 3, received prolonged EA with low-concentration solution of ropivacaine 0.1% within a day after surgery, in addition to the basic therapy, consisting of a combination of NSAID and paracetamol. No one of the patients in group 3 (EA + GA required administration of narcotic analgesics. Twenty hours after the end of operation in group 3 (EA + GA) indicated almost complete absence of pain syndrome during activation in contrast to other groups. Epidural catheter in this group was removed on the average over 24-26 hours after the end of operation.

The duration of hospitalization after surgery in the studied groups did not have statistically significant differences (Table 7).

Table 7

Comparative analysis of the duration of hospitalization and assessment of the condition of the newborn, depending on the type of anesthesia

Researched indicator, M (P25; P75)		Groups			p, Kruskal-Wallis test
		Group 1 GA, n=23	Group 2 SA + GA, n=27	Group 3 EA + GA, n=30	
Postoperative hospital bed days		6 (5; 7)	7 (4; 9)	5 (4; 8)	0.078
Based on Apgar score	1 th minute	7 (6; 7)	7 (6; 7)	7 (7; 7)	0.397
	5 th minute	8 (7; 8)	7 (7; 8)	8 (7.75; 8)	0.189

Notes: EA — epidural anesthesia; GA — general anesthesia; SA — spinal anesthesia

The table shows, that in our study there were no statistically significant differences in assessing the condition of the newborn according to Apgar on the 1 st and 5 th minute of life depending on the type of anesthesia.

DISCUSSION

The conducted comparative study allows to make preliminary conclusions about benefits and disadvantages of various types of anesthesia during the delivery of patients with placenta accreta with subsequent organ-saving surgery. On our opinion, anesthetic tactics of conducting patients with this pathology should be clearly defined, as well as the and equipment surgical treatment. Taking into account modern views on the need of contact between a mother and a newborn with the first seconds of life: skin contact, breastfeeding attachment and so on, anesthesia prior to the delivery must ensure not only adequate analgesia, but the possibility of a conscious contact with the newborn. From this point of view, regional anesthesia should be the method of choice prior to the delivery. On the other hand, when the diagnosis of placenta accrete is confirmed intraoperatively, the continuation of regional anesthesia without managed breathing can be dangerous due to unpredictable volume of intraoperative blood loss. In connection with this the conversion of regional anesthesia in common with controlled breathing without signs of separation of the placenta should be performed in a planned manner. This is due to the fact, that in an emergency situation when massive bleeding begins, in conditions of regional anesthesia and spontaneous respiration the delay of external respiration and violation of oxygen delivery to tissues and episodes of hypoxia occur [11, 15, 17]. On the other hand, analysis of publications shows, that the use of combined spinal and epidural anesthesia for placenta accreta increases [14, 18, 19, 26]. But most of all it is a description of the individual cases, a retrospective study, showing a high rate of switch to GA at the peak of bleeding [11, 12, 14]. Perhaps, as far as methods of treating placenta accreta improve and the risk of massive blood loss reduces, the use of combined spinal - epidural anesthesia and other regional methods without GA will be more secure.

The comparison of presented hemodynamic patterns revealed, that a combination of SA prior to the delivery and GA on the stage of metroplasty was accompanied by a decrease in performance of the heart in all major phases of operations. Saving hemodynamic parameters at safe levels required more intensive, than in the two other groups, vasopressor support, and was accompanied by a statistically significant increase in the concentration of lactate in the blood at all stages of the operation. The most stable hemodynamic pattern was noted in the EA group prior to the delivery with planned switch to GA at the metroplasty stage. In this group statistically significantly smaller number of vasopressors was required to maintain hemodynamics at a safe level, and stable level of lactate was observed. In group 1 (GA) significant negative dynamics of cardiac index and SBP during surgical pause was observed, when this total need in vasopressor support was significantly higher, than in group 3 (EA + GA).

The positive effect of the combination of EA and GA (group 3) was no significant increase level of cortisol at all stages of operation, which indicated an effective antinociceptive protection with the possibility of blockade of pain impulses at all levels of the perception of pain during the surgery in contrast to other two groups. In group 1, the full blockade of the pain impulse to the stage of transduction and transmission was not available due to characteristics of GA. In group 2 subarachnoid blockade performed at the beginning of operation was limited by time and not always provided effective blockade of the initial stages of perception of pain to the end operation. This can explain the more significant increase in the level of cortisol at the end of the operation in these two groups. Probably, effective intra-operative analgesia in group 3 prevented the development of central sensitization, which together with the possibility to continue the epidural blockade in the postoperative period provided a low assessment of pain on VAS, more early activation of patients and the lack of need in narcotic analgesics in contrast to the other two groups.

As in earlier studies [20, 21] a significant reduction in the volume of blood loss and transfusion was observed in groups, where regional anesthesia was performed. However, existing in the present time, the data is not sufficient for the approval of the fact, that the decrease in the volume of blood loss is associated with the use of regional anesthesia and requires a more detailed multivariate analysis.

In our study, the type of anesthesia in organ-saving operations for placenta accrete did not affected neonatal outcomes. It is necessary to continue the research in this direction, as, for example, in 2016 results of clinical tests with the participation of 50 patients were published [12], where significantly better state of newborns and decrease the number of respiratory complications during the use of regional anesthesia prior to the delivery were observed.

CONCLUSION

The conducted study showed, that in planned operational organ-saving delivery of patients with placenta accreta the optimal anesthesia is epidural anesthesia with a planned switch to general anesthesia with artificial ventilation after the delivery. This method of anesthesia ensures optimal antinociceptive protection of the patient in for operative intervention and the first postoperative day. By comparison with subarachnoid anesthesia, performed prior to the delivery, the method is characterized by more stable hemodynamics, less need in vasopressor support and more efficient perfusion of tissues. The possibility of prolongation of epidural analgesia during first days after surgery is important. It promotes early activation of patients, prevention of paresis intestine, venous thromboembolic complications and gives the possibility of an early care for a newborn.

The undoubted advantage of the combination of regional and general anesthesia is a decreased volume of intraoperative blood loss and blood transfusion compared to the isolated general anesthesia, which is, like, and in studies of other authors, was shown in our work.

FINDINGS

1. For the planned organ-saving surgery for placenta accreta the most stable hemodynamics were shown when combining epidural anesthesia prior to the delivery with the subsequent planned switch to general anesthesia with artificial lung ventilation during metroplasty.

2. Epidural anesthesia in combination with general anesthesia after the delivery provides a high level of antinociceptive protection for intraoperative stage compared to other methods of anesthesia.

3. The combination of regional anesthesia with general anesthesia significantly reduces the volume of intraoperative blood loss and donor blood transfusion compared to similar data under general anesthesia.

4. Neonatal outcomes do not depend on the method of anesthesia in organ-saving operations for placenta accreta.

5. The high level of antinociceptive protection in conditions of epidural anesthesia in combination with general anesthesia at the intraoperative stage, and the possibility of prolongation of epidural analgesia postoperatively provide early activation and less severity of the pain syndrome in the first day after the operation, but does not influence on the duration of hospital stay in a hospital.

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Received on 04.12.2019
Accepted on 28.02.2020