



ASSESSMENT OF THE EFFECT OF NEURAXIAL BLOCKADES ON EXTERNAL RESPIRATORY FUNCTION IN WOMEN WITH COMMUNITY-ACQUIRED PNEUMONIA AND RESPIRATORY FAILURE DURING ABDOMINAL DELIVERY

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Article history:	Abstract:
Received: September 10 th 2024 Accepted: October 8 th 2024	Current anaesthesia guidelines indicate that general anaesthesia in patients with pneumonia, especially in pregnant women, is considered to increase the risk of anaesthetic complications and maternal mortality, and should therefore be avoided if possible [1,2,5]. However, a review of the literature revealed that according to data on maternal mortality in the UK, aspiration is the main cause of perioperative mortality during induction, aspiration pneumonitis, hemodynamic collapse and subsequent resuscitation failure. At the same time, in the United States, cases of mortality at the stage of induction of general anesthesia were not recorded [3,4,6].

Keywords:

Cases of anesthesia-related deaths occur mainly in the postoperative period and are due to hypoventilation or airway obstruction due to premature extubation [7,8,9]. In addition, systemic errors associated with the insufficient competence of anesthesiologists are recognized as the main factor in mortality [1,10,11]. Nevertheless, in a number of clinical situations, general anesthesia remains the preferred method for abdominal birth in patients with pneumonia, when regional blockades are impossible, severe cardiopulmonary insufficiency is present, coronary reserves are reduced or absent, as well as with a high risk of massive bleeding [12,13].

During general anesthesia in pregnant women, the ventilation-perfusion ratio is disturbed, and hyperemia and swelling of the mucous membranes of the respiratory tract worsen their patency. Nasal congestion and voice changes are typical manifestations of physiological changes during pregnancy. These symptoms can be exacerbated by hydration and edema (severe forms of gestosis, preeclampsia, eclampsia), which impedes nasal breathing, disrupts airway obstruction, increases the risk of injury to the mucous membranes during tracheal intubation, and increases susceptibility to bacterial infections [7,8,12]. These changes can also lead to an increase in the alveolar-capillary oxygen gradient and a predisposition to the development of atelectasis in a prolonged supine position.

By the end of pregnancy, the minute volume of the lungs increases by 50% due to an increase in tidal volume and respiratory rate [9,13]. It should be noted

that it is still unclear which type of respiratory support is most effective in pregnant women suffering from pneumonia with respiratory failure.

OBJECTIVE: to study and conduct a comparative assessment of the effect of spinal and epidural anesthesia on respiratory function, acid-base balance, blood gas composition and saturation level in women with community-acquired pneumonia and acute respiratory deficit of the first degree.

MATERIALS AND METHODS OF RESEARCH. The study was conducted in the period from 2014 to 2023 in the multidisciplinary clinic of Samara State Medical University, Maternity Hospital No 3 in the city of Samarkand and in the Regional Perinatal Centers among 86 pregnant women with community-acquired pneumonia and acute respiratory deficiency of the first degree who were being treated. In all pregnant women of this group, repeated abdominal delivery was chosen as an indication for surgery.

The examined pregnant women were divided into three groups depending on the anesthesia approach. In the first group, spinal anesthesia was performed with a hyperbaric solution of 0.5% bupivacaine with oxygen supply in the CPAP mode (FiO₂ 60-100%) and non-invasive ventilation of the lungs with PEEP 5-10 mm of water. In the second group, epidural anesthesia was used with an isobaric solution of 0.5% bupivacaine with oxygen supply in the CPAP mode (FiO₂ 60-100%) and non-invasive ventilation of the lungs with PEEP of 5-10 mm of water. In the third group, balanced epidural anesthesia was performed with isobaric solution of 0.375% bupivacaine with oxygen supply in the CPAP



mode (FiO₂ 60-100%) and non-invasive ventilation of the lungs with PEEP of 5-10 mm of water. With an infusion of propofol at a dose of 0.3-4 mg/kg/h or intravenous dexmedetomidine at a rate of 0.2-0.7 µg/kg/hour (mean 0.7 µg/kg/hour). In all groups, anesthesia was carried out at all stages of the operation against the background of nasal oxygenation (8-10 l/min).

All methods of anesthesia were carried out according to generally accepted methods. Diphenhydramine (0.2 mg/kg) and dexamethasone (8 mg) were used for premedication. The efficiency of external respiration and the degree of acute respiratory deficiency were determined by measuring respiratory rate (RP), tidal volume (DI), minute respiratory volume (MOD), vital capacity (VC) and minute ventilation (MVL) using the spiographic method (SpiroCom Standard, Ukraine) and spirometry CONTEC SPIROMETR SP70B (China). The acid-base state of the blood was studied using the SIMENS-348 device (Germany), while using the Astrup micromethod, pH, pCO₂, pO₂, HCO₃⁻, BE in capillary blood were determined. The examination of pregnant women was carried out at four stages of the operation: the first stage - on the surgical table, the second stage - before the skin incision, the third stage - during the

wound stage, the fourth stage - after the completion of the operation.

The results obtained in the study were processed by the method of variation statistics using the Student's criterion (using Microsoft Excel) and presented in the form of M±m, where M is the arithmetic mean, m is a standard error. The differences were considered statistically significant at p<0.05.

DISCUSSION OF THE RESULTS OBTAINED. The data on the effect of anesthesia options on external respiratory function, acid-base state, blood gas composition and SpO₂ are shown in Table 1. The table shows that the preoperative parameters of external respiratory function corresponded to those in women without respiratory failure suffering from community-acquired pneumonia. An increase in respiratory rate to 23.9-24.8 per minute and a decrease in tidal volume to 4.38-4.52 ml/kg is associated with pneumonia and acute respiratory deficiency. as well as with an increase in intra-abdominal pressure, high standing of the diaphragm and a decrease in the volume of lung tissue unaffected by inflammation. At the same time, adequate minute ventilation was maintained in all three study groups (1, 2 and 3) due to compensatory tachypnea.

Table 1:

Effects of anesthesia options on respiratory function, acid-base state, and blood gas composition

Indicators	Group	Table Surgery	Before the skin incision	Wound stage	After the end of the operation
Respiratory rate, per minute	1	24,2±0,6	20,8±0,4 *	21,6±0,3 *	21,4±0,4 *
	2	24,8±0,5	21,6±0,4 *	22,2±0,3 *	21,6±0,3 *
	3	23,9±0,6	21,6±0,3 *	22,8±0,4	21,3±0,3 *
Tidal volume, ml/kg	1	4,52±0,21	4,56±0,22	4,42±0,21	5,12±0,24*□
	2	4,38±0,29	4,48±0,26	4,36±0,32	5,16±0,22*•□
	3	4,56±0,29	4,61±0,32	4,51±0,26	5,24±0,23*□
Minute ventilation, ml/kg*min	1	110,2±4,8	96,2±3,6 *	95,2±3,1 *	108,2±3,6 □
	2	109,6±4,2	98,7±3,2 *	96,8±3,3 *	111,8±3,4 □
	3	109,1±3,9	102,4±3,8	101,7±3,2	112,2±3,4 □
Ph	1	7,33±0,014	7,32±0,011	7,32±0,012	7,34±0,011
	2	7,34±0,012	7,33±0,09	7,33±0,011	7,34±0,09
	3	7,34±0,013	7,33±0,012	7,33±0,012	7,35±0,011
pCO ₂ , mmHg	1	29,8±0,6	32,3±0,4 *	32,6±0,3 *	32,4±0,3 *
	2	30,4±0,6	32,6±0,6 *	32,4±0,4 *	32,6±0,4 *
	3	30,2±0,5	33,1±0,4 *	32,6±0,3 *	32,2±0,4 *
pO ₂ , mm Hg	1	74,6±1,9	74,8±1,6	74,1±1,8	76,4±1,6
	2	74,5±1,6	74,6±1,6	74,9±1,9	75,8±1,6
	3	74,3±2,1	74,8±1,4	75,6±1,6	77,2±1,4
VE, mmol/l	1	-7,2±0,32	-7,8±0,34	-7,9±0,42	-7,4±0,32
	2	-7,6±0,41	-7,8±0,44	-7,6±0,34	-7,2±0,28
	3	-7,4±0,34	-7,6±0,32	-7,6±0,34	-7,2±0,28
SpO ₂ , %	1	92,9±1,3	92,6±1,1	93,2±0,9	93,8±1,2
	2	92,8±1,2	92,4±1,4	93,8±1,1	94,2±1,3



	3	92,6±1,4	92,4±1,2	93,6±0,9	94,6±1,2
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Table 1 presents the results of a study of the effect of various anesthesia options on the parameters of respiratory function, acid-base state and blood gas composition. The following symbols were used to indicate statistically significant differences: * — significant differences compared to the previous values ($p < 0.05$); □ — significant differences compared to the previous stages of the study ($p < 0.05$); ▲ — significant differences compared to group 3 ($p < 0.05$); ● — significant differences between groups 1 and 2 ($p < 0.05$).

According to the results of the study, pO_2 and SpO_2 values were slightly lower than the physiological norm, amounting to 74.3–74.6 mm Hg, respectively, and 92.6–92.9%. Before the first stage, the respiratory rate in all three groups decreased by 8.8–14.1%, which was more pronounced in patients who received spinal anesthesia (SA). This is due to partial blockage of the intercostal nerves under the influence of an anesthetic. At the same time, tidal volume did not change significantly, but the minute volume of breathing decreased by 12.8% in the first group, by 9.6% in the second group and by 6.2% in the third group. Acid-base status, blood gas composition and SpO_2 remained unchanged. However, pCO_2 in all three groups significantly increased by 7.2–9.6%. At the stage of wound surgery, the indicators of spontaneous breathing in all three study groups maintained a significant trend compared to the previous stages. There was a tendency to increase SpO_2 , which can be explained by respiratory support in CPAP mode with oxygen delivery at 60–100% FiO_2 and positive end-expiratory pressure (PEEP) of 5–10 mm water. After the completion of surgery, all three groups showed a significant increase in tidal volume and minute ventilation, as well as a tendency to increase pO_2 and SpO_2 .

CONCLUSIONS: In pregnant women with community-acquired pneumonia and grade I acute respiratory failure, epidural anesthesia with low-dose bupivacaine combined with an infusion of propofol at a dose of 0.3–4 mg/kg/h or dexmedetomidine at a dose of 0.7 µg/kg/h intravenously, at an average rate of 0.2–0.7 µg/kg/h, is optimal. Waters and oxygen supply with FiO_2 of 60–100%.

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