

PATHOPHYSIOLOGY OF EXTERNAL RESPIRATION IN WOMEN WITH PNEUMONIA DURING ABDOMINAL DELIVERY

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Summary: Pneumonia complicates the course of pregnancy and adversely affects the intrauterine development of the fetus. In this regard, the question of the advisability of prolonging pregnancy, determining the timing and methods of delivery, and the choice of anesthetic care should be decided strictly individually, depending on the nature of the pulmonary pathology.

Relevance. Pregnant women are at high risk of influenza exposure and its serious complications [2,3]. Although pregnancy does not increase the risk of pneumonia, pneumonia during pregnancy is more severe, increasing the risk of maternal and infant mortality and premature birth. Pneumonia remains one of the main causes of non-obstetric maternal mortality [1,4]. Risk factors for pneumonia during pregnancy include bronchial asthma, HIV infection, cystic fibrosis, COVID -19 viral infection, anemia (in particular, sickle cell anemia), smoking, alcohol and drug use. About 24% of pregnant women with pneumonia have aggravating factors or concomitant diseases. Smoking increases the risk of pneumonia in pregnant women by 3 times, bronchial asthma - by 5.3 times, and anemia - almost 10 times [4].

In turn, pneumonia complicates the course of pregnancy and also adversely affects the intrauterine development of the fetus [5,6]. In this regard, the question of the advisability of prolonging pregnancy, determining the timing and methods of delivery, and the choice of anesthetic management should be decided strictly individually, depending on the nature of the pulmonary pathology, the functional state of the respiratory system and its reserve capabilities: it is advisable to take into account not so much the specific nature of the pulmonary pathology as the degree of respiratory failure (RF), the functional state of the respiratory system, and the preservation of its reserve capabilities at the time of delivery. Information on preoperative preparatory tactics for abdominal delivery in pregnant women with pneumonia has not yet been fully determined [7,6]. With abdominal delivery performed under general combined anesthesia with mechanical ventilation, respiratory complications



occupy one of the leading places in the postoperative period (up to 30%) and are the leading cause of postoperative mortality [8,7].

Regardless of the type of anesthetic assistance in the immediate postoperative period, a number of factors contribute to atelectasis. These are residual myoplegia and drug-induced depression of consciousness, postoperative pain, the formation of a rapid shallow breathing pattern, an increase in intra-abdominal pressure with a limitation of diaphragm excursion [9,5]. Therefore, the development of a concept for adequate preparation of the respiratory system in pregnant women with pneumonia before delivery can be considered relevant and timely.

Quite a few studies have been conducted on the pathophysiology of external respiration during various surgical operations under central blockade conditions, but there is no single preparatory scheme for pregnant women with low respiratory reserves in the preoperative period. Thus, the problem of preparing the respiratory system in patients with pneumonia for abdominal delivery requires further study.

Objective of the study. Evaluation of the pathophysiology of external respiration during abdominal delivery in women with pneumonia

Materials and methods of the study. We observed 30 pregnant women with severe community-acquired pneumonia (CAP) (mean age 25.8 ± 6.0 years). The gestation period ranged from 18 to 38 weeks. The pregnant women were distributed as follows: primiparous — 17 (56.7%), multiparous — 7 (23.3%), multiparous — 6 (20%). 9 (30%) pregnant women were in the second trimester of gestation, 21 (70%) — in the third. During this pregnancy, ARVI was suffered by 7 (23.3%) patients in the early stages of gestation. The control group consisted of 30 clinically healthy women with physiological pregnancy of the same age range and gestation periods. In the clinic, general blood and urine tests, biochemical blood tests, and studies of the main indices of the respiratory system were urgently performed. Normative indices of pregnant women with physiological pregnancy were taken as a control. Instrumental methods of examination included ultrasound of the uterus and fetus, liver, kidneys, ECG, echocardiography. Written informed consent was obtained from all patients. For vital indications, 26 pregnant women with severe CP underwent emergency cesarean section with laparotomy according to D. Cohen. The operation was performed in the lower uterine segment using the Misgaf method. Ladah with ligation of three pairs of main vessels of the uterus for the purpose of preventing uterine hypotension, coagulopathic bleeding and postoperative septic complications. All patients underwent non-invasive ventilation of the lungs (NIVL) in the continuous mode positive airway pressure - CPAP and volume - cycled assisted / controlled ventilation - ACV using a VELA respirator (Viasys , USA 2003). During NIVL, oxygen was inhaled into the circuit at a flow of 2-5 l/min, ventilation was performed through an oronasal mask. During the entire operation and postoperative period, patients were monitored for respiratory rate, FEV1, SpO2 , heart rate, and blood pressure. Statistical processing of materials was performed using the Excel package . The results obtained were processed using the unpaired Student criterion.

Results and discussion. The condition of women with CP upon admission to the hospital was assessed as severe, and in four cases, as extremely severe, accompanied by cardiovascular dysfunction and respiratory failure. The duration of the disease before admission to the hospital ranged from 1 to 8 days (on average, 4.21 ± 0.48 days). The following features of the course of severe CP in pregnant women were observed: a distinct seasonal pattern of morbidity (autumn - winter) was observed, which coincided with an increased incidence of influenza and acute respiratory viral infections.

At the time of hospitalization, as a rule, there were signs of severe respiratory failure: forced position of pregnant women (orthopnea), dyspnea, lack of air. Patients complained of cough, mostly dry, fever, palpitations, severe weakness, headache, fear, three women had psychomotor agitation. During examination, attention was drawn to the presence of moderate diffuse cyanosis, especially pronounced on the upper and lower extremities ("stockings, socks"), tachypnea from 28 to 42 per 1 min, tachycardia from 96 to 154 beats / min. At the height of the disease, a shortening of the percussion sound was noted over the lesion in the lungs, auscultation - signs of pneumonic infiltration (an area of bronchial breathing and / or a focus of inspiratory crepitations or fine bubbling rales).

All pregnant women had a tendency to hypotension: the average systolic and diastolic blood pressure was 104.2 ± 10.8 and 64.6 ± 6.6 mm Hg, respectively.

Changes in the central nervous system in pregnant women with severe VP were characterized by headaches, dizziness, and sleep disturbances. At the height of the disease, clinical signs of euphoria appeared against the background of severe intoxication. Neurological deviations were expressed in a negative reaction to being in the intensive care unit, refusal of treatment and procedures.

The following complications were detected upon admission to the hospital: acute respiratory failure (ARF) grade I-II in 24 (80%) patients, ARF grade III in 6 (20%), infectious toxic shock in 8 (26.7%), and adult respiratory distress syndrome in 2 (6.7%). The hemoglobin content in the blood averaged 95.0 ± 10.9 g/l, ESR 38.0 ± 4.7 mm/h, and moderate leukocytosis was detected in 8 (26.7%) women. In 60% of patients, liver dysfunction was detected, which was confirmed by an increase in the level of total bilirubin from 29.2 to 85.64 mmol / l (with normal liver enzyme levels) with a predominance of direct fractions (from 13.9 to 45.54 mmol / l), while in the remaining 40% it remained within the upper limit of the norm. All subjects with severe CAP had a clinical picture of acute renal failure. insufficiency - a decrease in hourly diuresis to 30.0 ml - in 14 (46.7%), from 31 to 40 ml - in 11 (36.7%), from 41 to 50 ml - in 5 (16.6), with an increase in concentrations urea and serum creatinine.

In order to identify the causative agent of pneumonia, all pregnant women underwent a PCR test for COVID-19 and a bacteriological examination of sputum. A positive result was obtained in ten cases: group D streptococcus was detected in two cases, Candida fungi in three cases, and a positive test for coronavirus infection was detected in five cases . Such a

low percentage of positive results is apparently due to the collection of sputum samples after the start of antibacterial and antiviral therapy in an outpatient setting. An analysis of prehospital therapy showed that pregnant women received symptomatic treatment and antibiotics, mainly cephalosporins, often chaotically. The following changes in external respiration were detected in pregnant women with severe CAP (Table 1):

Table No. 1

Spirometry parameters in pregnant women with pneumonia upon admission to hospital.

Indicators	Group of patients	
	I (n=3.0)	II(n=34)
Respiratory rate in min	19.45±1.83	17.77±1.78
YELLOW, %	85.08±17.8	89.53±15.54
FVC, %	92.01±17.38	95.59±16.09
FEV, %	95.99±18.24	99.55±17.9
Tiffeneau index, %	86.49±8.12	87.14±7.53
POS, %	76.76±17.91	79.95±18.68
SOS ₂₅₋₇₅ , %	91.39±27.24	94.16±24.53

When patients with EP are admitted to hospital, changes in the main parameters of the spirogram are equally registered in both groups. Statistically significant differences are found in the respiratory rate and vital capacity, while changes in other parameters in the groups are not statistically significant.

The indices of pulmonary gas exchange, external respiration, respiratory comfort characterizing the condition of patients at the time of inclusion in the study, as well as hemodynamic indices are presented in the table (see Table 2). The studied indices of hemodynamics in pregnant women of the 1st group decreased to normal values and this index was stably maintained until the 5th stage of the study. Also, pregnant women of the 1st group showed a decrease in respiratory rate to physiological values with a simultaneous increase in FEV and blood oxygen saturation indices and an improvement in general well-being. In pregnant women of the 2nd group, the severity of clinical manifestations decreased slightly.

Respiratory and hemodynamic parameters at the stages of abdominal delivery in pregnant women with community-acquired pneumonia.

Table No. 2

Stages	Stage 1		Stage 2		Stage 3		Stage 4		Stage 5	
	1 group	2 group	1 group	2 group	1 group	2 group	1 group	2 group	1 group	2 group
FEV1, %	38.5±0.7	37.4±0.8	45.3±0.8	39.1±0.5	53.5±0.4	49.4±0.5	66.4±1.8**	59.5±0.7	72.3±1.7**	67.6±1.3
Respiratory rate, in 1 min	23.7±1.8	23.6±1.6	24.3±1.2	24.6±1.1	20.1±1.6	22.5±1.5	19.8±1.1**	20.3±1.6	18.1±1.4**	19.3±1.6
SpO2	91.3±0.8	90.2±0.5	93.8±0.8	91.4±0.7	96.4±0.6	93.9±0.7	98.2±1.5	94.5±0.8	99.2±0.6	95.5±0.7
Heart rate	94.3±1.2	96.8±1.3	96.6±1.2	98.6±1.7	89.5±1.3	93.3±1.4	86.4±1.3	90.2±1.5	84.5±1.4	88±1.3
GARD EN	109.6±1.6	108.9±1.7	90.7±2.3	98.6±1.9	92.8±1.4	102.3±1.6	92.8±1.4	102.3±1.6	89.1±1.2	98.4±1.6

Note *- reliability of differences $p_1 < 0.05$ compared with the initial values; ** - $p_2 < 0.05$ compared with the previous stages of the study.

The parameters studied differed significantly from the initial preoperative values. A clear tendency for the respiratory rate to decrease to physiological values with a simultaneous increase in FEV and blood oxygen saturation was recorded. The course of the immediate postoperative period was smooth. Disappearance of dyspnea and the absence of the need for intubation with prolonged mechanical ventilation were noteworthy.

These indicators can be used as markers of DIC syndrome in pregnant women with severe CP. Due to the severity of the condition and the increase in multiple organ failure, in the next few hours after admission to the hospital, 21 (87.5%) pregnant women underwent emergency cesarean section for vital indications. It is noteworthy that in the next few hours after operative delivery and against the background of NIVL, as well as ongoing intensive

syndrome therapy, the condition of the women in labor tended to improve. In particular, tachypnea and tachycardia disappeared. The course of the postoperative period was assessed as satisfactory in all observations.

Conclusions:

The course and outcome of CP in pregnant women depend on early recognition of the disease and timely and adequate therapy. In case of late treatment and delay in the start of treatment, the outcome may be unfavorable. Distinctive features of CP in pregnant women are the fulminant course of the disease and the rapid development of pulmonary and extrapulmonary complications. The results of the study of the respiratory system indicate that pregnant women with severe CP constitute a risk group for the development of severe complications and require adequate correction in the preoperative period. At the same time, non-invasive ventilation of the lungs becomes an important tool for respiratory support in intensive care. It has been proven that in a certain category of patients, NIVL allows avoiding tracheal intubation and traditional mechanical ventilation, helps to reduce the risk of complications and mortality. Thus, the use of NIVL indicates its high efficiency and safety. The obtained results allow us to recommend combined anesthesia with NIVL to ensure abdominal delivery in pregnant women with pneumonia.

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