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СОСТОЯНИЕ ФУНКЦИИ ВНЕШНЕГО ДЫХАНИЯ У БЕРЕМЕННЫХ В ЗАВИСИМОСТИ ОТ СТЕПЕНИ ОЖИРЕНИЯ

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АННОТАЦИЯ

Введение: Ожирение у беременных является важным фактором риска нарушения функции внешнего дыхания в результате изменения механики дыхания и повышения внутрибрюшного давления. Изучение респираторных показателей у данной категории больных имеет важное значение при оценке дородового состояния и анестезиологического риска. Цель: оценить характер и степень показателей, характеризующих функцию внешнего дыхания у женщин с различной степенью ожирения в третьем триместре неосложненной беременности. Материал и методы: проведено сравнительное исследование показателей функции внешнего дыхания и SpO_2 у 145 женщин с физиологически протекающей беременностью с умеренным весом и различной степенью ожирения и у 19 здоровых женщин без беременности. Результат: согласно результатам исследования, с увеличением массы тела усиливаются нарушения функций жизненно важных органов, и эти нарушения отчетливо проявляются при увеличении индекса массы тела (ИМТ) до 35-40 кг/м^2. Даже при умеренном течении беременности с увеличением массы тела усиливается функциональная недостаточность функции внешнего дыхания, недостаточность кровообращения, уменьшение дыхательного резерва. Заключение: у относительно здоровых беременных в возрасте 37-39 недель с умеренной и повышенной массой тела наблюдаются незначительные изменения в функции внешнего дыхания при полном сохранении резервной способности. При тяжелом ожирении к родовому периоду развиваются патологические изменения в дыхательной деятельности, резко снижается резервный потенциал и возникает дыхательная недостаточность.

Ключевые слова: внешнее дыхание, беременность, ожирение.

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ASSESSMENT OF PULMONARY FUNCTION IN PREGNANT WOMEN ACCORDING TO THE DEGREE OF OBESITY

ANNOTATION

Introduction. Obesity in pregnant women is an important risk factor for impaired pulmonary function due to alterations in respiratory mechanics and increased intra-abdominal pressure. The assessment of respiratory parameters in this group of patients is of considerable importance for evaluating pre-delivery status and anesthetic risk. Purpose: To assess the nature and degree of change in the parameters characterizing the respiratory function in the third trimester of pregnancy in patients with varying degrees of obesity on the background of uncomplicated pregnancy. Materials and Methods: We analyzed the results of comparative study of respiratory function and SpO2 in 145 women with physiological course of pregnancy occurring on the background of normal, overweight body mass and obesity, as well as in 19 healthy non-pregnant women. Results: With increasing body mass progressive functional impairment of the respiratory system and gas exchange are noted, reaching a maximum at BMI of 35-40 or more kg/m2. With increasing BMI even at normal pregnancy functional impairment of the respiratory system progresses that results in respiratory insufficiency and reduced reserve capacity of the respiratory and circulatory systems. Conclusions: There are minor changes of respiratory function in relatively healthy patients with normal and excessive body weight in the gestational ages in 37-39 weeks. In severe forms of obesity by the period of delivery, in the respiratory system are formed serious pathological changes, indicating respiratory failure.

Key words: pregnancy, overweight, obesity, respiratory function.

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HOMILADOR AYOLLARDA SEMIZLIK DARAJASIGA QARAB TASHQI NAFAS FUNKSIYASINING HOLATI

ANNOTATSIYA

Kirish: Homilador ayollarda semizlik nafas olish mexanikasining o'zgarishi va qorin ichi bosimining ortishi natijasida tashqi nafas funksiyasi buzilishlarining muhim xavf omili hisoblanadi. Ushbu toifadagi bemorlarda respirator ko'rsatkichlarni o'rganish tug'ruq oldi holati va anesteziologik xavfni baholashda muhim ahamiyatga ega. Maqsad: turli darajadagi semiz ayollarda asoratlanmagan homiladorlikning uchinchi uch oyligida tashqi nafas funksiyasini tavsiflovchi ko'rsatgichlarining xarakter va darajasini baholash. Material va usullar: mo'tadil vazn va semizlikning turli darajalari bilan 145 ta homiladorligi fiziologik kechayotgan ayollar va 19 ta sog'lom homilasi yo'q ayollardagi tashqi nafas faoliyati va SpO_2 ko'rsatkichlari qiyosiy tekshirildi. Natija: tadqiqotlar natijasiga ko'ra tana vazni oshib borishi bilan hayotiy muhim a'zolar faoliyati buzilishi kuchayib boradi va tana vazni indeksi (TVI) 35-40 kg/m^2 gacha oshishida bu buzilishlar yaqqol namoyon bo'ladi. Homiladorlik mo'tadil kechganida ham tana vazni oshib borishi bilan tashqi nafas faoliyati funksional yetishmovchiligi, qon aylanishi yetishmovchiligi, nafas rezervi kamayishi kuchayib boradi. Xulosa: tana vazni mo'tadil va oshgan 37-39 haftalik nisbatan sog'lom homiladorlarda zahira imkoniyati to'liq saqlanishi bilan tashqi nafas faoliyatida biroz o'zgarishlar kuzatiladi. Og'ir darajadagi semizlikda tug'ruq davriga kelib nafas faoliyatida patologik o'zgarishlar rivojlanadi, zahira imkoniyati keskin pasayadi va nafas yetishmovchiligi yuzaga keladi.

Kalit so'zlar: tashqi nafas, homiladorlik, semizlik.

Obesity (O) is a medical and social problem in modern society, the relevance of which is determined by the progressive increase in obesity. According to WHO data, 80% of the world's population had excess body weight by the end of the 20th century [1, 5-7]. The incidence of obesity is also increasing among pregnant women [1, 2]. Meanwhile, impaired lipid metabolism and progressive weight gain as gestation progresses provoke a number of pathological processes in the main life-support systems, including the function of external respiration. The reasons include the high position of the diaphragm, chest wall rigidity, increased kyphosis of the thoracic spine (which causes the ribs to take a horizontal position and the chest to become barrel-shaped), and increased intra-abdominal pressure. Therefore, the delivery of obese patients requires a thorough assessment of anesthetic and surgical risks, as well as a comprehensive evaluation of the pregnant woman's preoperative (prepartum) condition, including the study of the functional state of external respiration. However, these changes remain the least studied.

Purpose of research

Assessment of the nature and extent of changes in parameters characterizing external respiratory function in the third trimester of pregnancy in patients with varying degrees of obesity during an uncomplicated pregnancy.

Материал и методы

External respiratory function and spO_2 were studied in 145 women with a physiological pregnancy and normal body weight, overweight, or obesity, as well as in 19 healthy non-pregnant women. The general characteristics of the examined women are presented in Table 1. The patients were divided into six groups. The 1st group consisted of 19 somatically healthy non-pregnant women with a BMI of 19–24.9 kg/m^2, and the 2nd group consisted of 34 relatively healthy pregnant women with normal body weight (BMI of 19–24.9 kg/m^2). The 3rd group included 34 pregnant women, the 4th group 32 pregnant women, the 5th group 23 pregnant women, and the 6th group 22 pregnant women with overweight and obesity, corresponding to BMI levels of 25–29.9, 30–34.9, 35–39.9, and ≥40 kg/m^2, respectively. The groups of pregnant women were comparable in age, height, and gestational age, differing only in body weight and BMI. External respiratory function was studied by spirography using a SpiroComStandart spirograph (Ukraine). Respiratory rate (RR) per minute, tidal volume (TV), minute ventilation (MV), vital capacity (VC), maximum voluntary ventilation (MVV), and breathing reserve (BR) were analyzed. The results of the breath-holding test and hemoglobin oxygen saturation (spO_2) were also evaluated. The obtained data were processed by variation statistics using Student's t-test and presented as M±m, where M is the arithmetic mean and m is the standard error. Differences were considered statistically significant at $p<0.05$.

Results and discussion

Data on the functional state of external respiration are presented in Table 2. The baseline values characterizing the function of external respiration and gas exchange in pregnant women with normal body weight (Group 2) at 37-39 weeks of gestation fell within the range of their physiological fluctuations, but differed from those in non-pregnant women (Group 1), which was manifested by a significant decrease in TV, MV, VC, and MVV by 10.1%, 10.8%, 30.7%, and 29.7%, respectively. RR increased by 14.2%; BR and SpO2 decreased by 3.2%

and 2.1%, respectively. However, these changes were not statistically significant. Moderately pronounced changes (deterioration) in lung volumes, pulmonary ventilation, respiratory mechanics, and respiratory reserves should be attributed to pregnancy (increased abdominal volume and intra-abdominal pressure, high position of the diaphragm). At the same gestational age, patients with excess body weight (Group 3, BMI 25-29.9 kg/m2) demonstrated a significant increase in RR by 16.1% and a decrease in TV by 27% (Table 2).

Changes in other parameters characterizing the functional state of external respiration and gas exchange were not statistically significant, although a clear trend toward their deterioration was observed.

An increase in BMI to 30-34.9 kg/m^2 (Grade I obesity) was accompanied by a significant 24.3% increase in RR, as well as a decrease in TV, MV, VC, and MVV by 32.1%, 14.5%, 38.5%, and 37.3%, respectively. BR decreased to 91.6%, and SpO2 to 95.2±0.3%. Noteworthy is the significant decrease in parameters characterizing pulmonary ventilation (RR, MV, MVV) and lung volumes and capacities (TV, VC), as well as the decrease in BR. At the same time, it should be noted that the observed changes are not catastrophic in nature. An increase in BMI to 35-39.9 kg/m2 (Grade II obesity, Group 5) was accompanied by a significant and even more pronounced deterioration of the parameters.

Table 1. General characteristics of the patients

Indicator	Group 1, n=19	Group 2, n=34	Group 3, n=34	Group 4, n=32	Group 5, n=23	Group 6, n=22
Age, years	23,6±3,1	24,2±2,4	24,6±3,6	25,1±2,8	26,2±3,1	26,8±3,3
Body mass, kg	61,4±4,8	63,5±5,9	74,6±3,2*	89,9±5,2*	98,8±3,6*	109,7±6,3 *
Height, cm	164,2±3,6	165,4±3,8	165,1±3,4	163,4±4,1	165,4±3,2	163,4±4,1
BMI, kg/m^2	22,9±4,1	23,8±3,6	27,3±2,5	33,7±3,2	36,2±2,8*	41,4±3,2*
Gestation period, weeks.	-	38,6±0,4	38,2±0,6	38,3±0,8	37,9±0,5	37,3±0,6

Note. * - p < 0.05 compared to the data of pregnant women without obesity.

Table 2. Certain indicators of external respiration and SpO2 in pregnant women with normal, excess body weight, and obesity at 37-38 weeks of gestation

Indicator	Group 1, n=19	Group 2, n=34	Group 3, n=34	Group 4, n=32	Group 5, n=23	Group 6, n=22
Respiratory rate in min	16,8±0,8	19,2±1,2	22,3±0,5a	23,9±0,4a	24,2±0,3a	25,3±0,2a
Tidal volume, ml/kg	8,47±0,5	6,72±0,49в	5,58±0,52a	4,56±0,42a	3,36±0,3аб	3,18±0,2a
Minute ventilation, ml/min/kg	142,8±5,5	127,4±4,9в	124,9±3,6	108,9±3,5аб	81,5±4,2аб	80,4±1,9a
Vital capacity, ml/kg	76,9±8,1	53,3±6,3в	46,1±4,2	32,8±2,3аб	24,9±2,6аб	23,1±1,8a
Maximum voluntary ventilation , l/kg	1,18±0,05	0,83±0,04в	0,73±0,08	0,52±0,03аб	0,38±0,03аб	0,32±0,03a
Breathing reserve,%	86,9±2,3	84,2±2,4	82,6±2,1	77,1±1,8аб	77,5±2,3a	74,2±2,6a
SpO_2,%	98,4±0,6	96,4±0,8	96,4±0,5	95,2±0,3аб	94,2±0,4аб	94,2±0,3a
Respiratory retention test,	33,4±2,3	28,4±2,5	26,8±1,4	21,8±1,6аб	19,2±0,9a	18,8±0,6a

Note. p<0.05: a – compared to pregnant women with normal body weight; b – compared to the group of pregnant women with lower BMI; c – when comparing patient data from groups 1 and 2.

Thus, the RR in pregnant women of the 5th group was 24.2 ± 0.3 per minute; TV, MV, VC, and MVV were significantly lower than in pregnant women with normal body weight by 50%, 36.9%, 56.7%, and 61.4%, respectively. The SpO2 level was 94.2 ± 0.4%, and RD was 77.5%. Noteworthy is the catastrophic decrease in TV, VC, and MVV, which inevitably resulted in a deterioration of SpO2 and a sharp decline in the results of functional tests. An increase in BMI to 40 kg/m2 or more (the 6th group) contributed to the progression of signs of functional and respiratory disorders.However, compared to patients with a lower BMI (group 5), these changes were not significant.

At the same time, we would like to note that a decrease in TV below 5 ml/kg is considered catastrophic [3], and a decrease in VC below 40 ml/kg indicates severe functional insufficiency of the external respiratory system, manifesting as decreased lung compliance, impaired neuromuscular control of breathing, and obstructive and restrictive disorders [4].

Thus, as body weight increases, functional disorders of the respiratory system and gas exchange progress, reaching a maximum at a BMI of 35-40 kg/m2 or higher. As body weight increases, even during a normal pregnancy, functional disorders of the respiratory system progress, manifesting as respiratory insufficiency and a decrease in respiratory and circulatory reserves, which reach their maximum at a BMI of 35-40 kg/m2 or higher.

Conclusions

1. In relatively healthy patients with normal and excess body weight at 37-39 weeks of gestation, there are minor changes in external respiratory function, while its reserve capacity is fully preserved.

2. In severe forms of obesity (BMI of 35-40 kg/m2 or higher), pronounced pathological changes in the respiratory system develop by the time of delivery, and reserve capacities decrease sharply, reflecting respiratory insufficiency.

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