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Pregnancy in patients with bronchial asthma

Ciąża u pacjentek z astmą oskrzelową

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Summary

Asthma is a heterogeneous inflammatory respiratory tract disease characterized by bronchial hyperreactivity and typical clinical symptoms. It is the most common respiratory disease during pregnancy and affects 3-12% of women. The course of asthma in pregnancy can be unpredictable and depends on the severity of the disease before pregnancy. Pregnant patients with asthma are at a higher risk of miscarriage, premature delivery and pregnancy-induced hypertension. In the case of airflow limitation, bronchial obstruction and respiratory alkalosis lead to an impaired uterine blood flow, therefore maternal hypoxia is much more dangerous for the developing foetus than for the patient herself. The therapeutic strategies for pregnant asthmatic patients do not differ from treatment standards in other groups of patients and involve the so called stepwise therapy. The currently available antiasthmatics are safe for pregnant women. They should be used at minimum doses ensuring effective control of the disease symptoms. The course of asthma is most effectively controlled by inhaled corticosteroids, which are considered to be 'a golden standard' in anti-inflammatory treatment. Short-acting inhaled β_2-agonists are routinely used in dyspnoea attacks. Pregnant patients with asthma should remain under strict control of both a gynaecologist and a GP. The scope and frequency of ultrasound examinations in II and III pregnancy trimester depend on asthma severity and suspected foetal pathology. Asthma is usually stable during labour. Patients are advised to continue the use of antiasthmatics during delivery.

Streszczenie

Astma jest heterogenną chorobą zapalną dróg oddechowych, charakteryzującą się obecnością nadreaktywności oskrzeli i występowaniem typowych objawów klinicznych. Jest najczęstszą w okresie ciąży chorobą układu oddechowego i występuje u 3-12% kobiet. Przebieg astmy podczas ciąży bywa nieprzewidywalny, uzależniony od stopnia ciężkości choroby przed ciążą. U ciężarnych chorych na astmę zwiększa się ryzyko wystąpienia poronień, porodów przedwczesnych czy nadciśnienia tętniczego indukowanego ciążą. W sytuacji ograniczenia przepływu powietrza, wskutek obturacji oskrzeli i nasilenia fizjologicznej alkalozy oddechowej u ciężarnej, upośledzony zostaje przepływ krwi przez macicę, co powoduje, że hipoksja u matki jest znacznie bardziej niebezpieczna dla rozwijającego się płodu niż dla samej pacjentki. Zasady leczenia astmy u ciężarnych nie odbiegają od standardów wytyczonych dla innych grup chorych i jest to tzw. terapia stopniowana. Obecnie dostępne na rynku „leki przeciwastmatyczne" są bezpiecznie dla kobiet w ciąży. Należy je stosować w najmniejszych dawkach zapewniających skuteczną kontrolę objawów choroby. „Złotym standardem" w leczeniu przeciwzapalnym są glikokortykosteroidy wziewne, najskuteczniej kontrolujące przebieg astmy. W opanowaniu napadu duszności rutynowo stosowane są krótko działające β_2-mimetyki wziewne. Ciężarne z astmą oskrzelową powinny pozostawać pod ścisłą kontrolą zarówno lekarza ginekologa, jak i internisty. Zakres i intensywność wykonywania badań USG w II i III trymestrze ciąży zależy od stopnia ciężkości astmy oraz sytuacji podejrzenia patologii płodu. Podczas porodu przebieg choroby jest zazwyczaj stabilny. Zaleca się, aby rodząca nie przerywała stosowania leków przeciwastmatycznych.

Conflict of interest
Konflikt interesów
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INTRODUCTION

Asthma is a heterogeneous inflammatory disease of the respiratory tract involving a number of cells and substances they produce (eosinophil, mast cell and T-cell infiltration). Chronic inflammation causes bronchial hyperreactivity leading to characteristic, recurrent

clinical manifestations such as wheezing, dyspnoea, chest tightness and cough, which usually occur at night and early in the morning. These episodes are usually accompanied by diffuse bronchial obstruction of varying severity, associated with various degrees of impairment in exhaust airflow through the respiratory tract. Airflow obstruction is due to smooth muscle contraction and bronchial mucosal oedema, formation of mucosal plugs and bronchial remodelling (1, 2).

Asthma is the most common respiratory disease during pregnancy and affects 3-12% of women. Due to the increasing number of cases, asthma in pregnancy has become an important clinical problem posing a challenge for attending physicians (3-6). The clinical classification of asthma depends on the frequency of symptoms, forced expiratory volume in one second (FEV1) and peak expiratory flow (PEF). Furthermore, classification into atopic (extrinsic) and non-atopic (intrinsic) asthma, which takes into account whether exacerbation is due to allergens (atopic) or not (non-atopic), is also useful.

NAEPP (National Asthma Education and Prevention Program) classification is shown in table 1 (7).

Diagnosis is usually made prior to pregnancy. If new symptoms occur during pregnancy, additional tests may be needed, with the simplest and most common being the spirometry. It should be noted, however, that bronchial hyperresponsiveness tests are contraindicated in pregnancy due to insufficient data on their safety. Allergy skin tests are also not recommended due to the potential risk of systemic anaphylactic reaction, which poses a threat for both the mother and the foetus (6, 8).

MATERNAL RESPIRATORY CHANGES DURING PREGNANCY

Mucosal oedema and hyperaemia virtually over the entire length of the airway due to capillary dilation occur during pregnancy. Placental growth hormone is primarily responsible for this phenomenon, whereas progesterone has dilatory effects on the trachea and bronchi, which results in an increased alveolar ventilation. There are also changes in the configuration of the chest. The diaphragm is raised by the growing uterus by approx. 4-5 cm, which results in a broader setting of the ribs and, consequently, increased transverse dimensions of the chest by about 6 cm. Elevation of the diaphragm has no significant effects on its mobility and no respiratory muscle weakness is observed. The tidial volume (TV) increases by 35-50% and the inspiratory capacity (IC) increases by an average of 5-10% with the progress of pregnancy. The altered setting of the convexity of the diaphragm, which is not fully compensated by the widening of the lower costal arch, results in a reduced functional residual capacity (FRC) by about 18%, i.e. 300-500 mL, with a uniform reduction in its components: expiratory reserve volume (ERV) and residual volume (RV). In most cases, no significant changes occur in the total lung capacity (TLC) or vital capacity (VC) during pregnancy. Increased tidal volume and reduced residual volume elevate alveolar ventilation by 65%. There is an increase in the central respiratory drive from week 13 of pregnancy, which is not normalised until 24 weeks after delivery. Both, oxygen consumption and metabolic rate increase with advancing gestational age, which forces an increase in minute ventilation by up to 50%. This change, together with pregnancy-associated physiological respiratory alkalosis, is one of the fundamental changes in the acid-base balance. Maternal hyperventilation, which is probably due to the effects of progesterone on the respiratory centre and the susceptibility of the peripheral chemoreceptors (carotid bodies), also occurs (3, 6, 8, 9). Normal blood gas results in a pregnant woman are as folows: pH – 7.40-7.45, pO_2 – 100 mmHg, pCO_2 – 25-32 mmHg, HCO_3 – 18-21 mEq/L (3, 6).

INTERACTIONS BETWEEN ASTHMA AND PREGNANCY

The effects of pregnancy on asthma

Different studies have shown that a stable course of disease may be expected in 22-41% of patients, clinical condition improvement will occur in 18-36% of patients and symptom exacerbation will affect 22-42% of patients. The percentages can be summarised as follows: pregnancy has no effects on asthma in 1/3 of women, the disease becomes milder in 1/3 of patients while aggravation occurs in 1/3 of women. The third group includes women with poorly controlled asthma before pregnancy. The clinical symptoms do not differ significantly during subsequent pregnancies in the same pa-

Tab. 1. Control levels for asthma in adults, adolescents and children up to 6 years old (the assessment includes the last 4 weeks)

The level of asthma control	Fully controlled	Partially controlled		Uncontrolled
	Mild episodic	Mild chronic	Moderate chronic	Severe chronic
Symptoms	≤ 2 times per week	> 2 times per week, but < 1 daily	Everyday exacerbations ≥ 2 times per week	Throughout each day
Lung function (PEF or FEV1)	≥ 80% predicted value Daily variation in PEV < 20% Normal PEF in the period between exacerbations	≥ 80% Daily variation in PEF 20-30%	60-80% Daily variation in PEF > 30%	≤ 60% Daily variation in PEF > 30%
Night waking	≤ 2 nights a month	> 2 nights a month	> 1 night a month	Each night
Daily activities	No effects	Minimal limitation	Moderate limitation	Significant limitation

*The classification was slightly modified based on GINA 2014 report, by removing lung function assessment from the criteria (1)

tient (2, 3, 6, 9). Although it is not fully understood why pregnancy has an effect on asthma, hormonal changes are considered the main cause.

Factors accounting for asthma improvement:

- an increase in minute ventilation due to elevated progesterone levels allowing for respiratory centre function in response to pCO_2,
- an increase in tidal volume and a decrease in residual volume,
- reduced pulmonary resistance and increased pulmonary compliance (18-50%),
- increased synthesis of the natriuretic hormone and prostaglandin E (PGE_2) – a substance with bronchodilator effects,
- increased beta-adrenergic response due to increased synthesis of progesterone and free cortisol.

Factors accounting for asthma exacerbation:

- decreased functional residual capacity (FCR), which means that even minor bronchial obstruction significantly impairs the ventilation/perfusion ratio,
- reduced pulmonary reactivity to cortisol as a result of competitive binding of progesterone to glucocorticoid receptors,
- increased synthesis of $PGF_{2\alpha}$ showing the strongest bronchospasm activity,
- increased susceptibility to viral and bacterial infections,
- susceptibility to gastro-oesophageal reflux (3).

Although the course of asthma in pregnancy may be unpredictable, it depends on the pre-conception asthma severity – severe asthma is the most important risk factor for exacerbations during pregnancy. Exacerbations most often occur between 24 and 36 weeks gestation. Asthma attacks during labour are rare, which may be related to symptom reduction and milder disease during the last 4 weeks of pregnancy (2, 6).

The effects of asthma on pregnancy

A number of studies have shown an increased risk of miscarriage, preterm birth, pregnancy induced hypertension and eclampsia as well as haemorrhage, hyperemesis gravidarum or perinatal maternal complications (respiratory arrest, mediastinal emphysema) in pregnant patients with asthma. The incidence of these complications is closely related to the level of asthma control during pregnancy (3, 6, 9).

The effects of asthma on foetal development

An increased incidence of intrauterine growth retardation (IUGR), foetal distress, intrauterine foetal death as well as low birth weight < 2,500 g and higher rates of perinatal mortality of newborns has been shown among pregnant patients with asthma, particularly those noncompliant with or modifying treatment regimen for fear of therapy-induced adverse effects (3, 6, 9). The various above described respiratory changes occurring in pregnancy significantly compensate for the increased oxygen demand. Limited airflow due to bronchial obstruction and an increased physiological respiratory alkalosis in a pregnant patient lead to an impaired uterine blood flow, therefore maternal hypoxia is much more dangerous for the developing foetus than for the patient herself (6). Since the foetal respiratory reserve is relatively small, an increased physiological hyperventilation, which has significant effects on reduced maternal venous return, is an additional factor promoting intrauterine foetal hypoxia.

THERAPEUTIC MANAGEMENT IN PREGNANT PATIENTS

An effective control of asthma during pregnancy is based on four integral principles for the medical management:

1. Objective methods for the assessment of the clinical status of the patient and treatment monitoring.
2. Avoidance or complete elimination of exposure to factors that exacerbate the disease (inhalant allergens, tobacco smoke, intense odours or air pollution).
3. Proper patient education aiming at a partnership between the doctor, the patient and patient's family.
4. Adequate pharmacotherapy to reduce respiratory inflammation and treat asthma exacerbations (1, 6, 7).

The therapeutic strategies for asthmatic pregnant patients do not differ from treatment standards in other groups of patients and involve the so called stepwise therapy. Early diagnosis of exacerbations, implementation or intensification of treatment, depending on symptoms, as well as preventing uncontrolled episodes of hypoxia, which is particularly dangerous for the developing foetus (at $pO_2 < 60$ mmHg and patient's oxygen saturation $SaO_2 < 95\%$), are the primary objectives of therapeutic management (1, 2, 6, 7, 9). The patient should discuss treatment strategy with her physician, including medication safety and administration techniques (correct inhalation), as well as receive training on asthma control assessment (PEF self-measurement), management strategies in exacerbations as well as a follow-up visit schedule.

PHARMACOTHERAPY IN PREGNANCY

Virtually all currently available antiasthmatic agents are safe for pregnant women. These agents should be used at minimum doses effective for symptom control. Inhalant agents, which directly reach the respiratory tract with minimum adverse effects, are preferred. The drug classes used in acute and chronic treatment are presented below (1-3, 6, 7, 9).

Inhaled β_2-agonists (β_2-mimetics)

Salbutamol is currently a drug of choice. It is a fast- and short-acting agent (SABA) used as a quick relief to stop asthma attacks and control bronchospasms or for prophylactic use before a potential exposure to an allergenic factor. All pregnant women with asthma

should keep this medication with them. The dose of inhaled salbutamol used for internal reasons is much lower than the dose used in the prevention of premature uterine contractions. Despite the lack of sufficient data on the safe use of long-acting β_2-agonists (LABA) (formoterol and salmeterol), treatment with these agents can be implemented in moderate to severe chronic asthma, but only in combination with inhaled corticosteroids, when monotherapy is ineffective in controlling exacerbations. Oral and intravenous β_2-agonists are not recommended since they can impair the uteroplacental flow, cause tachycardia and muscle tremor in the patient or hypoglycaemia in the foetus. These agents belong to FDA category C.

Corticosteroids

Inhaled corticosteroids are the gold standard in the anti-inflammatory therapy in chronic asthma. They reduce the risk of asthma attacks during pregnancy as well as the risk of another hospitalisation in the case of exacerbation. Budesonide, which has a well-known safety profile in pregnant patients and foetuses, is a recommended agent. There are no studies clearly indicating a negative effect of other drugs in this group. Therefore, if sufficient asthma control was achieved in a patient with other agents, the switch to budesonide is not necessary. Systemic therapy (oral or intravenous) may be indicated in exacerbations. Agents which poorly cross the placental barrier (prednisone, prednisolone and methylprednisolone) or are inactivated by placental 11β-hydroxysteroid dehydrogenase (hydrocortisone) should be used. According to the available data, the use of oral steroids in the first trimester can increase the risk of cleft lip and cleft palate up to 0.2-0.3% (population risk 0.1%) (9). Long-term steroid therapy can cause gestational diabetes, increase the risk of preterm delivery, induce preeclampsia and low birth weight. This group of drugs belongs to FDA category C. Budesonide, which is classified in category B, is an exception.

Cromones

Sodium cromoglicate and nedocromil are a group of agents with bronchodilatory and weak anti-inflammatory effects, which can be safely used in pregnancy. These agents are suitable only for long-term treatment and belong to FDA category B.

Methylxanthine derivatives

Theophylline is used in an alternative therapeutic regimen for chronic asthma and shows no effects on exacerbations during pregnancy. Due to variable pharmacokinetics, it can be safely used in the second and third trimester. The dose should be reduced in the third trimester due to a decreased clearance of theophylline by about 25%. The drug has a narrow therapeutic window, therefore the risk of overdose is high. Serum theophylline levels should be monitored in patients – the recommended range is 5-12 mcg/mL. High doses can cause muscle tremor, tachycardia, insomnia and vomiting. Theophylline belongs to FDA category C.

Antileukotrienes

Although this group of drugs (zafirlukast and montelukast) can also be safely used in pregnancy, their therapeutic effect is weaker compared to inhaled corticosteroid monotherapy or combined therapy with long-acting β_2-agonists. Antileukotrienes are recommended for therapy continuation in patients with good asthma control before pregnancy. This group of drugs belongs to FDA category B.

Specific immunotherapy

So far, no adverse effects of specific immunotherapy continued during pregnancy have been observed. However, this therapeutic method should be used with caution due to the risk of anaphylactic reaction. Specific immunotherapy should not be initiated during pregnancy.

Additional therapeutic methods

Allergic rhinitis, sinusitis, respiratory bacterial and viral infections or gastroesophageal reflux disease have a negative impact on asthma. Therefore, treatment of these conditions is an integral part of the therapy.

Table 2 shows the current recommended therapeutic regimen for pregnant women.

Tab. 2. Recommended therapeutic regimen for pregnant patients (3, 6, 9)

Therapeutic intensity level	Recommended treatment regimen for asthma control	Alternative treatment regimen for asthma control	Rescue treatment
1	–	–	Short-acting β_2-agonist
2	Low-dose inhaled corticosteroid	LTRA, cromones, theophylline	Short-acting β_2-agonist
3	Medium-dose inhaled corticosteroid	Low-dose inhaled corticosteroid + LABA or LTRA or theophylline	Short-acting β_2-agonist
4	Medium-dose inhaled corticosteroid + LABA	Medium-dose inhaled corticosteroid + LTRA or theophylline	Short-acting β_2-agonist
5	High-dose inhaled corticosteroid + LABA	–	Short-acting β_2-agonist
6	High-dose inhaled corticosteroid + LABA + oral corticosteroid	–	Short-acting β_2-agonist

LABA – long-acting β_2-agonist; LTRA – antileukotriene

ASTHMA EXACERBATIONS

Every pregnant patient with asthma should be able to identify clinical symptoms suggesting exacerbation, such as increased dyspnoea, non-productive cough, wheezing over the lung fields as well as appropriately respond to 20% PEF reduction (self-management) or the weakening of foetal movements. Only early diagnosis and adequate treatment allow to reduce the risk of complications due to maternal and foetal hypoxia. The patient's appearance itself (cyanosis, a forced position of the body, difficulty speaking, consciousness disorders) may be an indicator of severe bronchial obstruction associated with a high risk of foetal hypoxia. Patients should undergo careful auscultation as well as have their blood pressure and the number of breaths measured. PEF or FEV1 measurement may be used for bronchoconstriction assessment. PEF should be expressed as a percentage of predicted or best value for a given patient (6). Oxygen saturation measurement is the primary test to assess the general condition of the patient. For $SaO_2 < 95\%$, arterial blood gasometry should be performed. A correct interpretation of blood gas results is also important. Even a relatively small increase in $pCO_2 > 32$ mmHg may result in respiratory acidosis and impaired foetal CO_2 removal. Furthermore, the condition of the foetus should be immediately evaluated (CTG and/or USG) and the patient should undergo a gynaecological examination – exacerbation is a significant risk factor for premature delivery. If indicated, a tocolytic therapy should be implemented (β_2-agonists, magnesium sulfate) (2, 3, 6, 9).

The early treatment (first hour) of asthma exacerbation involves:

- short-acting β_2-agonist (Salbutamol), 2-4 doses inhaled three times at 20-minute intervals from a metered dose inhaler or in the form of nebulisation (2.5-5 mg) with oxygen,
- oxygen therapy to achieve $SaO_2 > 95\%$ + continuous pulse oximetry,
- intravenous hydration via constant peripheral venous access,
- constant foetal monitoring (CTG),
- systemic corticosteroids for FEV_1 or PEF > 50% of the predicted value as well as in the case of rapid improvement following bronchodilator therapy and in patients who have recently received oral steroids (1, 2, 3, 6, 9).

The overall condition of the patient should be reassessed about one hour after treatment initiation.

Treatment of asthma exacerbations

The therapeutic management in a pregnant patient with asthma exacerbation depends on the severity of clinical symptoms and the overall status of the patient (2, 3, 6, 9):

- mild exacerbation – short-acting β_2-agonist in accordance with the above described regimen to be continued at 4-6-hour intervals for 24 hours in the case of good response to treatment (PEF > 80% of the predicted value),
- moderate exacerbation – gradual and careful nebulised β_2-agonist dose escalation for several hours at 60-minute intervals + systemic corticosteroids (oral or intravenous),
- severe exacerbation – continued nebulised β_2-agonist at 1-hour intervals + systemic corticosteroids (oral or intravenous) + ipratropium bromide inhalation at a dose of 500 ug + oxygen therapy to maintain $SaO_2 > 95\%$.

Moderate and severe exacerbation is an indication for maternal hospitalisation. Other indications include: lack of response to pretreatment, $SaO_2 < 95\%$, $PaCO_2 > 42$ mmHg, decreased foetal activity, impairment of maternal consciousness and somnolence. It should also be noted that the management of exacerbations should involve control and, if needed, treatment of water-electrolyte imbalance. The use of corticosteroids and β_2-agonists promotes hypokalaemia. In the case of poor response to therapy, persistent severe clinical symptoms of asthma and decreased foetal movement despite appropriate management, intubation and mechanical ventilation are indicated. Criteria for intubation in pregnant patients with asthma exacerbation include: $PaO_2 < 60$ mmHg, $PaCO_2 > 45$ mmHg, signs of exhaustion, including respiratory muscle fatigue, therapy-resistant respiratory acidosis (pH < 7.35), maternal consciousness impairment and confusion (6).

The differential diagnosis of asthma exacerbation includes maternal dyspnoea, perinatal cardiomyopathy, pulmonary oedema as a complication of tocolytic therapy and pulmonary embolism (6).

PRENATAL CARE

Pregnant patients with asthma should remain under strict control of both a gynaecologist and an internist-pulmonologist. The attending physician should perform a careful assessment of patient's condition, disease severity and signs that may indicate approaching exacerbation during a routine follow-up visit. Furthermore, patients' compliance to antiasthmatic agents should be evaluated as it is essential to ensure an appropriate control of asthma (2, 6, 7, 9). A correct determination of the gestational age (based on first trimester ultrasound) as well as careful monitoring of foetal development are also fundamental. The scope and frequency of ultrasound examinations in II and III trimester depend not only on the severity of asthma. Increased frequency of ultrasound with biophysical profile and Doppler assessment of foetal blood flow is indicated in suspected intrauterine growth restriction as well as after each asthma exacerbation (7, 9). Beta-blockers are absolutely contraindicated in pregnant patients with hypertension due to their strong bronchospasm activity (2, 3, 9). Oxytocin is the drug of choice for labour induction, but PGE_1 (Prostin) or PGE_2 (Prepidil) in the form of suppositories or vaginal gel can also be used. The use of 15-methyl-$PGF_{2\alpha}$ (Carboprost), ergonovine and methylergonovine should be avoided due to the risk of bronchospasm (3, 6, 9). Early pregnancy

termination by caesarean section is indicated relatively rarely, only in the absence of improvement after intensive pharmacotherapy. The overall condition of the patient improves after delivery due to lower oxygen consumption and uterine shrinkage, which alters the respiratory mechanics (6, 9).

ASTHMA MANAGEMENT DURING LABOUR

Asthma is usually stable during the perinatal period (2, 3, 6, 9). Patients are recommended to continue antiasthmatic treatment. Systematic monitoring of foetal condition (foetal heart rate auscultation, CTG) and oxygen saturation (recommended level SaO_2 > 95%) as well as PEF measurement (on admission and at 12-hour intervals) are indicated during hospitalisation in the delivery room. Pregnant patients should be well-hydrated; peripheral venous access should be used. Intravenous hydrocortisone, e.g. 100 mg IV at 8-hour intervals should be used during labour and for the next 24 hours in patients using oral corticosteroids for > 4 weeks prior to delivery to prevent adrenal crisis, which occurs in highly stressful situations, such as childbirth. Epidural anaesthesia has significant effects on the course of labour as well as reduced oxygen consumption and minute ventilation. Histamine-releasing drugs (morphine, pethidine) are contraindicated. Fenantil is a preferred analgesic (2, 3, 6, 9). Antiasthmatics should be continued after delivery; there are no contraindications for breastfeeding due to very small amounts of drugs excreted in breast milk (2, 9).

CONCLUSIONS

Asthma is the most common chronic respiratory disease in pregnant women and a significant clinical problem requiring a close cooperation between the gynaecologist and an internist-pulmonologist. Hormonal changes are considered the main cause underlying the effects of pregnancy on asthma. Although the course of asthma in pregnancy may be unpredictable, it depends on the pre-conception asthma severity. Studies have shown no relationship between the use of antiasthmatics and pregnancy complications or foetal defects. Inappropriate asthma control and ineffective treatment of exacerbations pose a greater threat for the mother and the foetus than the potential adverse effects of therapy. The therapeutic strategies for asthmatic pregnant patients do not differ from the general treatment standards and are referred to as a stepwise therapy. Inhaled corticosteroids, which represent a gold standard in anti-inflammatory treatment, and short-acting inhaled β_2-agonists, which are used as a rescue treatment in dyspnoea attacks and bronchospasm, are the mainstay treatment for asthma. If no satisfactory asthma control is achieved, long acting β_2-agonists should be considered. Cromones and antileukotrienes are second-line therapy. The basic management in asthma exacerbations aims to ensure appropriate maternal blood oxygenation and continuous foetal monitoring since maternal hypoxia is much more dangerous for the developing foetus than for the patient herself. The main classes of drugs used to treat asthma exacerbations in pregnant patients include short-acting inhaled β_2-agonists and oral or intravenous corticosteroids. Moderate to severe exacerbation is an indication for inpatient treatment. In the case of poor response to therapy, persistent severe clinical manifestations of asthma and a real risk of intrauterine foetal hypoxia despite an appropriate therapeutic management, intubation and mechanical ventilation may be needed. In very rare cases, early pregnancy termination by caesarean section is indicated.

BIBLIOGRAPHY

1. Gajewski P, Mejza F, Niżankowska-Mogilnicka E: Rozpoznanie i leczenie astmy u dorosłych. Podsumowanie wytycznych GINA 2014. Med Prakt 2014; 9.
2. Niżankowska-Mogilnicka E, Bochenek G, Gajewski P: II Choroby układu oddechowego, C-Choroby dróg oddechowych, 6-Astma. [W:] Interna Szczeklika – Podręcznik chorób wewnętrznych 2014. Medycyna Praktyczna, Kraków 2014: 595-608.
3. Rogala B, Ropacka M: Choroby układu oddechowego. [W:] Bręborowicz GH (red.): Ciąża wysokiego ryzyka. Wyd. III uaktualnione i rozszerzone. Ośrodek Wydawnictw Naukowych, Poznań 2010: 801-806.
4. Schatz M, Dombrowski MP: Asthma in pregnancy. N Engl J Med 2009; 360(18): 1862-1869.
5. Schatz M, Dombrowski MP, Wise R et al.: Asthma morbidity during pregnancy can be predicted by severity classification. J Allergy Clin Immunol 2003; 112: 283-288.
6. Przybyłowski T: Astma podczas ciąży. Cykl „Choroby internistyczne u kobiet w ciąży" pod red. D. Moczulskiego i E. Wender-Ożegowskiej. Medycyna po Dyplomie. Wyd. Medical Tribune Polska 2012; 9: 12-19.
7. National Asthma Education and Prevention Program. NAEPP Working Group Report on Managing Asthma During Pregnancy: Recommendations for Pharmacologic Treatment – Update 2004. NIH Publication 05-5236. March 2005.
8. Whitty JE, Dombrowski MP: Choroby układu oddechowego w ciąży. [W:] Gabbe SG, Niebyl JR, Simpson JL et al.: Położnictwo. Ciąża prawidłowa i powikłana. Tom II. Wyd. I pol. pod red. P. Oszukowskiego i R. Dębskiego. Elsevier Urban & Partner, Wrocław 2014: 311-319.
9. Kempiak J: Zmiany ustrojowe w przebiegu ciąży. Zmiany w układzie oddechowym. [W:] Bręborowicz GH (red.): Położnictwo i ginekologia. Tom I. Wydawnictwo Lekarskie PZWL, Warszawa 2008: 45-47.

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