

Asthma in pregnant woman and its management: a review

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ABSTRACT

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Asthma is the most common comorbidity in pregnant women and gives 30% of exacerbation experience. The other 30% will see improvement of their symptoms, and the rest will not see the changes. Exacerbations have become a major clinical concern in pregnant women. Medical concerns for the mother and the childbirth included low birth weight, preeclampsia, and preterm delivery. The major goal is to keep asthma under control to ensure mother's health and well-being, as well as fetal growth. Controlling asthma and preventing exacerbations are the main goals of asthma treatment during pregnancy. Treatment for asthma should ideally begin before conception. This is to avoid day-time and night-time symptoms, as well as to keep lung function. Furthermore, fetal oxygenation is a crucial factor during the pregnancy. With a few exceptions, asthma drugs are basically the same in pregnancy as they are in non-pregnant people. Inhaled corticosteroids (ICS) are often used as a controlling treatment. Budesonide is the recommended ICS. Short-acting β -agonist (SABA) preferable as reliever in acute asthma and to relieve exacerbation. As an add-on therapy for medium to high dose ICS, long-acting β -gonists (LABA) is often used. Virus infections and ICS nonadherence are the two most common causes of asthma exacerbations during pregnancy.

ABSTRAK

Asma, sebagai komorbiditas paling umum pada wanita hamil, menyebabkan sebanyak 30% penderita mengalami eksaserbasi. Sebanyak 30% lainnya mengalami perbaikan gejala, dan sisanya tidak terjadi perbaikan. Eksaserbasi telah menjadi perhatian klinis utama pada wanita hamil. Masalah medis untuk ibu dan persalinan termasuk berat badan lahir rendah, preeklamsia, dan kelahiran prematur. Tujuan utama pengelolaan asma selama kehamilan adalah menjaga asma tetap terkendali untuk memastikan kesehatan dan kesejahteraan ibu, serta pertumbuhan janin normal. Mengontrol asma dan mencegah eksaserbasi adalah tujuan utama pengobatan asma selama kehamilan. Pengobatan asma idealnya harus dimulai sebelum pembuahan. Hal ini untuk menghindari munculnya gejala baik di siang dan malam hari, serta menjaga fungsi paru. Selain itu, oksigenasi janin merupakan faktor penting selama kehamilan. Dengan beberapa pengecualian, obat asma pada dasarnya sama pada kehamilan seperti pada orang tidak hamil. Kortikosteroid inhalasi (ICS) sering digunakan sebagai pengobatan pengontrol. Budesonide adalah ICS yang direkomendasikan. *Short-acting β -gonist* (SABA) lebih disarankan sebagai pereda asma akut dan untuk meredakan eksaserbasi. Sebagai terapi tambahan untuk ICS dosis sedang hingga tinggi, *long-acting β -gonists* (LABA) sering digunakan. Infeksi virus dan ketidakpatuhan ICS adalah dua penyebab paling umum dari eksaserbasi asma selama kehamilan.

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INTRODUCTION

Asthma is a chronic illness in which the airways narrow, swell, and produce extra mucus leading to breathing difficult, coughing, and a whistling sound. Asthma prevalence's has risen dramatically in recent decades including in pregnancy. Asthma is the most common comorbidity in pregnant women in which its prevalence increased from 3.7% in 1997 to 8.4% in 2001.¹ Asthma during pregnancy causes 30% of exacerbation, 30% of improvement of their symptoms, and the rest will not change.

The course of asthma can be unpredictable during pregnancy due to it is connected to an increased risk of perinatal consequences. The National Asthma Education and Prevention Program/NAEPP (2005) emphasizes the need of maintaining optimal asthma management throughout pregnancy for the health and well-being of both the mother and her infant. It is vital to keep a tight eye on things in order to make therapeutic adjustments. Although some pregnant women are hesitant to use drugs during pregnancy for fear of harming the fetus, epidemiologic evidence strongly supports the usage of asthma medications. Controlling asthma during the first trimester, when organogenesis is taking place, is very important.² This review discussed asthma during pregnancy and its management focusing pharmacological interventions.

DISCUSSION

Pathophysiology of asthma

Anatomic and physiologic alterations can occur during pregnancy. As the transverse diameter of the chest expands by roughly 2 cm, anatomic alterations include a broadening of the lower ribs and an increase in the subcostal angle. The diaphragm is raised by around 4 cm. The changes in the chest wall peak around 37 wk of pregnancy and then revert to normal after birth. Due to the relaxation of smooth muscle hormones in the airways, total airway resistance reduced

somewhat during pregnancy. During pregnancy, pulmonary compliance does not alter; nevertheless, chest wall compliance decreases, resulting in a reduction in overall respiratory compliance in late pregnancy. The impact of lowering airway resistance is larger than the effect of increasing chest wall compliance. The outcome is a 50% increase in total oxygen intake during pregnancy due to an increase in total labor of breathing.³

Asthma is characterized by bronchoconstriction symptoms such as shortness of breath, chest tightness, cough, and sputum production, which can be paroxysmal or persistent. With the treatment of β -agonists, symptoms must improve as well as objective improvements in pulmonary function tests such as FEV1 or PEFr. The diagnosis of asthma in pregnancy is identical to that of a non-pregnant patient. Physiologic dyspnea, not asthma or other pathologies, is a prevalent cause of respiratory symptoms like shortness of breath in pregnancy. Dyspnea during pregnancy, on the other hand, is rarely accompanied by cough, shortness of breath, or obstructive symptoms like asthma. Alternative diagnosis include gastric reflux illness, pneumonia, postnasal drip disease caused by allergic rhinitis, and bronchitis. If the clinical picture is compatible with asthma but there is no evidence of reversibility of the airway blockage, a trial of asthma medication can be used to diagnose asthma in pregnancy.⁴

Asthma is one particular disease entity with the category of obstructive pulmonary disease, characterized by limited airflow during expiration than inspiration. Asthma symptoms include airway obstruction, bronchial hyperresponsiveness, and airway edema with eosinophilic and lymphocytic inflammation. Inflammatory cells, cellular mediators, and environmental stimuli interact in this process. It is a chronic condition marked by recurring spells of wheezing and dyspnea caused by airway blockage. An asthmatic's airway is hypersensitive to allergens,

viral infections, air pollution, exercise, and cold air, among other things.³

A person who have asthma symptoms have airway inflammation. The epithelial cell lining of the airways displays hyperplasia and hypertrophy in asthmatic patients' endobronchial biopsies. The surface area of secretory cells and mucous glands increases as the number of epithelial cells increases. Many inflammatory cells (including eosinophils, neutrophils, monocytes, and lymphocytes) infiltrate the airway walls of asthmatics, causing epithelial damage, mucosal edema, aberrant neuronal processes, airway smooth muscle responses, and airflow restriction. Interleukin-3, IL-4, and IL-5, as well as granulocyte-macrophage colony-stimulating factors, can be produced by these cells. When the IgE receptor is activated or opened, it produces IgE. In asthma, the presence of IgE and eosinophils plays a key role in the inflammatory response. In addition to the cellular components that contribute to airway thickening, there is non-cellular airway thickening. The basement membrane thickens and the collagen component alters, both of which contribute to airway blockage and hyperresponsiveness.³

Total IgE levels have been connected to the prevalence of asthma. High serum levels are linked to persistent wheeze, early sensitization, and bronchial hyperresponsiveness in people of all ages. Patients with non-topic asthma release IgE all across their lungs. Mast cells and other airway cells become sensitive and active when IgE antibodies are created and the particular antigen is found. Following sensitization, two responses occur in response to allergen exposure.³

Early phase

The initial phase peaks at about 30 min after the appearance of the allergen and is mediated by an IgE-dependent process. The response occurs when IgE that binds to its receptors on the surface of effector cells then collides with the allergen. This causes inflammatory mediators to be stored from the effector

cell. The early response is associated closely with the level of free IgE.

Late phase

After allergen exposure, a delayed reaction of 4 to 8 h may develop. Inflammation that builds over time is the reason of the later response. Hyperactivity causes air trapping and lungs hyperinflation, resulting in bronchospasm, mucosal edema, and mucus plugging as symptoms. Acute bouts of shortness of breath, sneezing, or chest tightness define asthma exacerbations. As the obstruction in the airway worsens, exhalatory airflow declines but functional residual capacity increases. If left untreated, these alterations during pregnancy can lead to hypoxemia in the mother and, as a result, hypoxemia in the fetus, especially if maternal PAO_2 falls below 60 to 70 mmHg. The airway response to these stimuli includes bronchial smooth muscle spasm, mucus hypersecretion, and mucosal edema, all of which contribute to the pathogenesis of the disease's reversible airway blockage. Inflammatory alterations in the submucosa of the airways are present in all cases of asthma; this fact has prompted fresh thinking about asthma treatment.

Several physiologic changes occur during pregnancy that can alter the course of bronchial asthma, including: 1). A 15% rise in metabolic rate in pregnant women, with a 20% increase in oxygen intake and a 30 to 40% increase in minute ventilation (primarily due to tidal volume increase). Progesterone hormone stimulates the respiratory center, which causes hyperventilation. During pregnancy, hyperventilation causes respiratory alkalosis, which is characterized by a drop in arterial partial pressure of carbon dioxide, a decrease in bicarbonate, and an increase in pH; 2). The upward push on the diaphragm causes uterine size to grow, resulting in a decrease in functional residual capacity; 3). The transition from T-helper 1-type cytokine production to Th2-type immune responses, which is required for the baby' survival, is thought to be linked to

changes in maternal immunity during pregnancy; 4). Estrogen hormones may cause mucosal and laryngeal edema, resulting in rhinosinusitis in roughly 20% of pregnant women.

Etiology

Processes, causes, and effects of asthma exacerbations during pregnancy are poorly understood. Exacerbation rates of bronchial asthma during pregnancy have previously been related to increasing asthma severity. Other studies have revealed that nonadherence to bronchial asthma controller medication owing to fears of teratogenic consequences during pregnancy is a major risk factor for asthma exacerbations throughout pregnancy. Respiratory tract infections are also a risk factor for bronchial asthma exacerbations during pregnancy.⁵

Prevalence asthma

Between 1976-1980 and 1988-1994, the prevalence of asthma in adult women of reproductive age increased by twice, from 2.9 to 5.8%. The rise was tripled between the ages of 18 and 24, going from 1.8 to 6.0%. Women with asthma should seek preconception counseling to learn about the potential negative effects of asthma medications on the fetus and to maintain excellent asthma control, especially during the first trimester.⁶

Asthma is a chronic medical condition that is frequently reported during pregnancy and its prevalence in the population has increased in recent decades. There was an increase in the prevalence of asthma during pregnancy in 1997 was 3.7% and in 2021 was 8.4%. The most recent prevalence from the USA was found to be 5.5% in 2001, and increased to 7.8% in 2007. Prevalence is 9.3% in Ireland and 12.7% in Australia.⁷ Optimizing asthma management during pregnancy is very important to protect the health of mother and baby.⁸

Mechanisms of asthma remission or onset during pregnancy

The pathophysiology of asthma remission or worsening during

pregnancy is connected to the physiological or pathological changes brought on by pregnancy, such as the mechanical changes induced by uterine expansion and the direct or indirect effects of hormonal changes.⁶

The diaphragm is lifted by 4-5 cm when the uterus and abdominal pressure rises, from early to late pregnancy, the subcostal angle grows by 50% (from 68° to 103°), as does the thoracic transverse and anteroposterior diameter. The ligamentous attachments to the ribs relax, resulting in a reduction in thoracic compliance, which partially offsets the above alterations. As a result, total lung volume fell 5%, while FRC (functional residual capacity) fell 20%. In addition, gaining weight causes a larger neck circumference and a smaller oropharyngeal area, which both contribute to dyspnea during pregnancy.⁹

During pregnancy, a series of significant changes in hormone levels occur to satisfy the needs of maternal and fetal metabolism, including a noticeable rise in progesterone, estrogen, cortisol, and prostaglandin, all of which have various impacts on the course of asthma.⁹

Progesterone is a respiratory dynamics stimulant that increases the respiratory center's sensitivity to carbon dioxide, whereas estrogen increases the sensitivity of the progesterone receptor in the respiratory center, causing a change in respiratory function. Due to a 40% increase in tidal volume, minute ventilation rises by 30%–50%, but respiratory rate stays constant. TLC (total lung capacity), VC (vital capacity), lung compliance, and DLCO (diffusion capacity) remain unchanged.⁹

When compared to nonpregnancy, there are no significant changes in FVC (forced vital capacity), FEV1 (forced expiratory volume in 1 second), the ratio of FEV1 to FVC, or PEF (peak expiratory flow rate). As a result, spirometry can be used to detect dyspnea in healthy pregnant women and to track changes in respiratory disorders. In addition to acting on the respiratory center, progesterone can mediate mucosal vasodilation and congestion, resulting

in an increase in pregnancy rhinitis and epistaxis, as well as oropharyngeal and laryngopharyngeal airways, which contribute to asthma attacks during pregnancy.⁹

Estradiol can boost maternal innate immunity as well as adaptive immunity mediated by cells or humor. Estradiol in low concentrations can boost CD4+Th1 cell responsiveness and cell-mediated immunity. Estradiol in high concentrations can boost CD4+Th2 cell responsiveness and humoral immunity. Progesterone suppresses the maternal immune system and alters the balance of Th1 and Th2 responses. Although cell-mediated immunity plays a larger role in respiratory virus infections, the transition of Th1 to Th2 immunity is thought to be a key process in asthma caused by pregnancy hormones.⁹

Corticotropin-releasing hormone (CRH) and Adrenocorticotrophic hormone (ACTH) are secreted by the placenta during pregnancy, resulting in an increase in free cortisol and conjugated cortisol. Increased free cortisol causes an increase in beta-adrenoceptors, which worsens bronchiectasis. Increased prostaglandin E2 (PGE2) production during pregnancy protects against asthma via anti-inflammatory, smooth muscle cell proliferation decrease, bronchial relaxation, and other mechanisms. Progesterone can potentially cause bronchiectasis by altering airway smooth muscle tension. These factors are associated with asthma remission during pregnancy.⁹

The effects of mechanical and biochemical changes on a pregnant woman's respiratory system are complex in general. The effects of numerous hormones on the respiratory center, peripheral airway, and immune system, which cause nonasthmatic pregnant women to experience variable degrees of dyspnea throughout pregnancy. It is critical for asthmatic pregnant women to improve their asthma control during pregnancy in order to avoid maternal hypoxia and preserve appropriate fetal oxygenation.⁹

Respiratory physiology during pregnancy

During pregnancy, maternal experience many changes in respiratory physiology that are related to the pathophysiology of asthma (TABLE 1). An increasing minute ventilation occurs up to 40-50% in an effort to compensate for the increased oxygen demand during pregnancy, this condition is due to an increasing tidal volume.⁶ The respiratory rate was relatively unchanged but there were changes in some maternal with an increase in respiratory rate of <10%. Therefore, further studies should be conducted to investigate the incidence of tachypnea during pregnancy (respiratory rate >20).⁶

Hormonal changes are believed to be the main cause of hyperventilation. During pregnancy, there is a gradual increasing progesterone, at 6 wk gestation it increases to 25ng/mL and at 37 wk gestation it increases to 150 ng/mL.⁶ Progesterone is responsible for stimulating the respiratory center of the medulla and increasing the respiratory rate. When there is an increase in the respiratory rate, the upper respiratory tract undergoes hyperemia and mucosal edema, causing nasal congestion; reduced muscle tone produces bronchodilation that acts synergistically with free cortisol which has the potential to protect against inflammatory triggers (prostaglandins).¹⁰⁻¹² One of the pain mediators that have a potential protective effect on asthma is prostaglandin E2.⁹ However, prostaglandin F2a has a bronchoconstrictor effect that increases during pregnancy.⁶

During pregnancy, the metabolic rate increases by up to 15%, resulting in a high oxygen consumption (increases up to 20%). Hyperventilation causes respiratory alkalosis, which is compensated by metabolic acidosis.⁶ A moderate respiratory alkalosis is caused by maternal hyperventilation, which is compensated by metabolic acidosis. As the partial arterial pressure of oxygen (pO₂) rises, the partial arterial pressure of carbon dioxide (pCO₂) falls. Because

the oxygen tension in transfer from the maternal placental channels to the fetal interface blood supply is lower in the umbilical vein than in the placental arteriovenous capillary network, maternal hypoxemia (95 mmHg) immediately results in a lowered oxygen supply to the fetus. Chronic hypoxia may limit intrauterine growth and result in a decreased birth weight.^{6,10,11}

Anatomic alterations, albeit the most visible symptom of pregnancy and the cause of changes in lung volumes, have little impact on the airways. In later phases, however, changes in abdominal girth, pressure, diaphragmatic position, and chest wall size lead to an increase in the incidence of physiological dyspnea.^{13,14} Similarly, an expanding uterus promotes acid reflux by pushing the diaphragm forward 4–5 cm, increasing the subcostal angle by up to 50% (68° - 104°), and increasing chest

diameter by up to 2 cm.^{13,14} Pregnancy rhinitis is caused by mucosal edema, hyperemia, and capillary congestion, which all induce rhinitis and modify lung volume, starting in the first trimester and peaking in the third trimester.¹⁰

The functional residual capacity (FRC) is reduced by roughly 18-20% when the diaphragm is elevated, but the forced vital capacity (FVC) is maintained. With FRC, the expiratory reserve volume (ERV) decreases.^{10,15} Early in pregnancy, inspiratory reserve volume (IRV) diminishes, but increases in the third trimester.¹¹ The forced expiratory volume in one second (FEV1) or peak expiratory flow rate are not affected by pregnancy (PEFR). FEV1 and PEFR during pregnancy, like in the general population, correlate well with asthma symptoms and exacerbations, making them useful metrics to track asthma control.^{4,10,15}

TABLE 1. Changes in respiratory physiology during pregnancy^{10,16,17}

Parameters	Change
FEV ₁	Unchanged
FVC	Unchanged
PEFR	Unchanged
FEV ₁ /FVC	Unchanged
MMEF	Unchanged
Flow Volume Loop	Unchanged
Minute ventilation	↑↑ up to 50%
Tidal volume	↑↑ up to 40%
Respiratory rate	= / ↑ <10%
pH	= / ↑
pO ₂	= / ↑
pCO ₂	= / ↓
Pulmonary resistance	= / ↓ (unclear)
Diaphragm height	4-5 cm elevation
TLC, ERV, IRV and RV	↓ / ↓↓
FRC	↓ up to 18-20%
Upper airway vascular	↑
Mucus congestion	↑

FEV₁: forced expiratory volume in 1 sec; FVC: forced vital capacity; PEFR: peak expiratory flow rate; MMEF: maximum mid expiratory flow; TLC: total lung capacity; ERV: expiratory reserve volume; IRV: inspiratory reserve volume; RV: residual volume; FRC: functional residual capacity

Dyspnea during pregnancy

Difficulty breathing during pregnancy is common. Physiological changes during pregnancy can change the mother's respiratory function and gas exchange, which may cause respiratory problems during normal pregnancy. On the other side, dyspnea may be caused by pregnancy problems.¹⁸ Difficulty breathing during pregnancy is usually more severe in the sitting position and is not tiring. It begins in the first or second trimester, peaks in the second trimester, and then settles into a somewhat steady state in the third trimester. Normal pregnancy dyspnea occurs gradually. As a result, while dyspnea during pregnancy may be natural, it is most likely caused by asthma if it is accompanied by wheeze and/or coughing. Asthma should be diagnosed based on a medical history, physical examination, and lung function testing. Wheezing, coughing, chest tightness, and difficulty breathing are all signs of asthma. Usually, in the presence of environmental irritation and at night, asthma symptoms get worse. Patients usually have a known history of asthma. During the examination, the clinician may notice some breathlessness.⁶

Diagnostic asthma during pregnancy

Asthma during pregnancy is diagnosed using the same concepts as asthma in non-pregnant individuals. In an appropriate clinical setting with intermittent pulmonary symptoms (such as wheezing, coughing, shortness of breath, and chest tightness), the medical history should focus on the underlying causes of asthma and whether there are possible comorbidities such as gastroesophageal reflux disease, voice spinal cord dysfunction, Chronic sinus disease or rhinitis may mimic asthma symptoms or may lead to poor control.¹⁹

During pregnancy, if symptoms of asthma occur, a spirometer can be used to diagnose the severity of asthma in patients without a history of asthma. If the FEV1/FVC ratio decreases or women

show at least 12% improvement in FEV1 after inhaling short-acting beta agonists, the diagnosis of asthma can be confirmed. It is most important to give patients compliance and use asthma medications including controllers and relievers correctly. Therefore, monitoring peak flow, frequent consultation with a medical professional for inhaler technology, and developing an appropriate asthma management plan can help pregnant women reduce airway inflammation and asthma attacks. Blood tests can be performed to identify specific IgE antibodies against allergens, but due to the risk of systemic reactions, skin prick tests are not recommended.²⁰

Differential diagnosis of asthma during pregnancy

Asthma during pregnancy should be diagnosed using the following criteria 1). Difficulty breathing in pregnancy caused by hyperventilation; 2). Pulmonary embolism: Pregnancy is a procoagulant circumstances, which increases the risk of thromboembolism, particularly in people with other risk factors like as smoking; 3). Amniotic fluid embolism; 4). Bronchitis or pneumonia; 5). Postnasal drip due to allergic rhinitis or sinusitis; 6). Congestive heart failure, cardiomyopathy or pulmonary edema; 7). Gastroesophageal reflux disease; 8). Vocal cord dysfunction.⁶

Effects of asthma in pregnancy

According to a systematic study, the severity of asthma determines changes in the course of asthma during pregnancy, and asthma may influence the likelihood of unfavorable outcomes. In accordance with the studies on asthmatic women, uncontrolled asthma is linked to a slew of negative maternal and neonatal outcomes. Asthma during pregnancy is linked to an increased risk of the following illnesses including maternal pregnancy-related complications, perinatal adverse and congenital malformation.

Maternal pregnancy - related complications

Preeclampsia. Preeclampsia is defined as a systolic blood pressure (SBP) of 140 mmHg or a diastolic blood pressure (DBP) of 90 mmHg during pregnancy and accompanied with proteinuria (300 mg protein excretion per 24 hr). A meta-analysis of cohort studies on pregnant hypertension reported that the mother's asthma is linked to pre-eclampsia or eclampsia (RR= 1.28; 95% CI: 1.25–1.32; $p < 0.05$), and the Q analysis indicates homogeneity. In addition, a higher risk of asthma in association with preeclampsia was reported (RR=1.43; 95%CI: 1.31-1.57; $p=0.05$).

Pregnancy induced hypertension (PIH). Asthma is one of the most frequent underlying chronic disorders during pregnancy, with a global incidence ranging from 8 to 13%. Pregnant hypertension is defined as a SBP of 140 mmHg or higher, or a DBP of 90 mmHg or higher. After 20 wk of pregnancy, symptoms of pregnancy-induced hypertension (PIH) commonly occur. Transient hypertension in pregnancy is defined as a rise in blood pressure that occurs after 20 wk of gestation, followed by a return to normal blood pressure following the subsequent examination in the day evaluation unit. A total of 8,752,686 patients who had hypertension during pregnancy.²¹

Perinatal adverse

Low birth weight (LBW). Birth weight (BW) is a strong surrogate measure of fetal health throughout pregnancy. Babies with LBW are more probable to acquire the condition during the perinatal period and later in life. Recent research has demonstrated that LBW is a sign of adverse programming, with LBW neonates being more likely to develop diabetes, hypertension, obesity, and metabolic syndrome. The effects of LBW will be felt for the rest of a person's life. Studies have shown that during adulthood, people with lowbirth weight

have a significantly increased risk of dying from coronary artery disease.²² In children born between 22-28 wk, the cumulative morbidity is largest in newborns weighing <1000 g at birth and in extremely preterm neonates (RR=1.17; 95%CI: 1.15-1.18). At 22-28 wk, the adjusted RR of asthma inpatient nativity was 2.26 (95 % CI 2.10-2.43) as compared to full term (39-41 wk) children.²³

Small for gestational age (SGA). Small for gestational age is linked to a slightly higher incidence of hospitalization for term asthma, but not for preterm babies (RR=1.05; 95%CI: 1.04-1.06). Children born with SGA have a modestly higher incidence of asthma hospitalization (RR 1.20, 95 % CI 1.16-1.24).²³

Preterm babies. Preterm delivery is defined as premature delivery when the pregnancy is less than 37 wk.²² Premature birth may be associated with problems in the structure and function of the lungs at birth, which may raise the chance of developing asthma later in life. Preterm birth and asthma may potentially share genetic or environmental causes. For example, studies have found a link between maternal asthma and preterm delivery and pediatric asthma. Even preterm infants (37-38 wk) are more likely to be hospitalized for asthma than full-term newborns (RR=1.10; 95 % CI: 1.09-1.12).²³

Congenital malformation.

Maternal asthma episodes are linked to a 50% increase in the incidence of congenital abnormalities. Blais *et al.*²⁴ reported the prevalence of malformations in women with and without asthma attacks during pregnancy are 12.8% and 8.9%, respectively. The risk increases for women who did not get any oral corticosteroid prescriptions during pregnancy, and the risk doubled for women who do not received oral corticosteroids during the first trimester of pregnancy. A prescription for an oral corticosteroid does not imply that

the individual important utilized it. However, it may indicate that the patient is receiving great medical care and has an asthma represent plan that includes an oral corticosteroid if necessary.²³

Transient tachypnea of the newborn (TTN).

The most common benign and self-limiting clinical illness in newborns is transient tachypnea. However, several studies have connected temporary breathlessness in neonates to a wide range of neonatal morbidity.²⁵

Asthma management during pregnancy

According to the National Heart, Lung, and Blood Institute, NAEPP, the goal of treatment for pregnant asthma patients is to provide optimal therapy to maintain asthma control for maternal health and quality of life as well as for normal fetal growth. Controlled asthma is characterized as having minimum or no chronic symptoms during the day and night, no exacerbations, no restrictions on activities, near normal pulmonary function, minimal short acting β -agonists use, and no adverse reaction from asthma medications. Maintaining proper asthma control throughout pregnancy is critical for both the mother and the baby's health. Experts suggests that asthma status be monitored during prenatal visits, that albuterol be used as the preferred SABA, budesonide be used as an inhaled corticosteroids (ICS) for long-term control, and the use of intranasal corticosteroids to treat the comorbid condition of allergic rhinitis.²⁶

According to The Expert Panel Report of the Working Group Asthma and Pregnancy – 2004 update, there are four essential components for controlling asthma i.e. monitoring objective pulmonary function measurement, patients education, controlling asthma triggers and concomitant conditions, and pharmacologic therapy with a gradual approach.²⁶

Monitoring objective pulmonary function measurement

The evaluation of asthma history and pulmonary function should be conducted on a monthly basis. Spirometry is preferred for normal outpatient monitoring, however peak expiratory flow (PEF) measurement is usually sufficient. It is suggested that patients pay more attention to fetal activity. Periodic ultrasound tests beginning from 32 wk of pregnancy, may be considered for patients whose asthma management is not ideal. Ultrasound examination can also support the recovery process after severe exacerbation.

Patient education

Patients should be encouraged how to self-monitor, how to appropriately use inhalers, how to adhere to a long-term asthma treatment plan, and how to deal with the early signals of worsening symptoms. Murphy *et al.*⁸ reported that completing an educational program led to a significant improvement in asthma self management skills. Patients are informed about the advantages that asthma controlling moms and newborns can get if asthma is controlled during pregnancy.

Controlling asthma triggers and concomitant conditions:

Controlling and eliminating asthma-related trigger factors such as allergens, irritants, and cigarette smoke might improve maternal well-being and reduce the need for medication. Because respiratory illnesses are a common trigger for asthma exacerbation, pregnant women with asthma should obtain up-to-date influenza and pneumococcal immunizations.

Pharmacologic therapy with a gradual approach:

Treatment with a gradual approach to asthma control is to increase the dose, amount, and frequency of medications when needed, and decrease them if

possible (FIGURE 1). The studies found that pregnant women with poor asthma control used more acute medications and used fewer controlling drugs. The effectiveness of the drug in pregnant women is regarded the same as other

adult patients. Current recommendations for progressive treatment have been changed following a comprehensive evaluation of information from safety trials of asthma medicines during pregnancy by the NAEPP working group

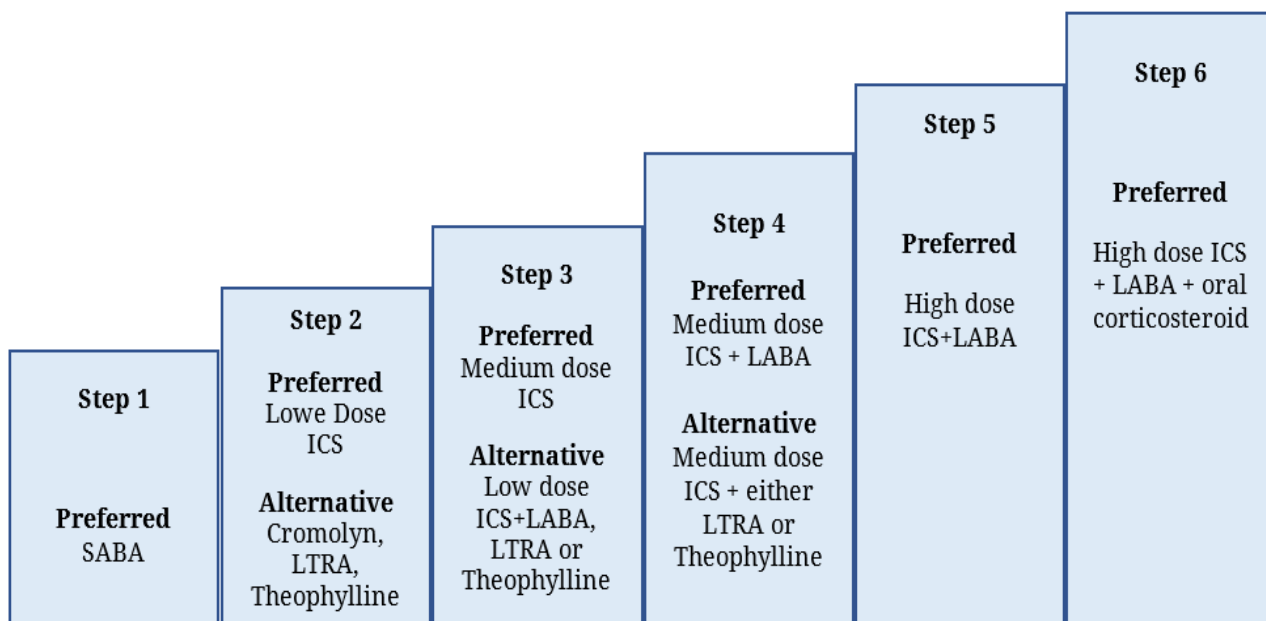


FIGURE 1. Gradual approach for managing asthma in pregnant women

Management of asthma exacerbation during pregnancy

Exacerbations of asthma are a typical clinical problem during pregnancy. Over 45% of asthmatic pregnant women experienced moderate to severe exacerbations during pregnancy necessitating medical intervention.⁸ Exacerbations, oral steroid use and severe asthma associated with premature birth, could be caused by hypoxia, maternal inflammatory effects, or alterations in the smooth muscle function of the uterus.⁸ As a result, asthma exacerbation during pregnancy should be treated

aggressively.²

A guideline for asthma exacerbation care at home, in the emergency room, and in the hospital was issued by the National Heart, Lung, and Blood Institute's National Asthma Education and Prevention Program's Asthma and Pregnancy Working Group - 2004 update (FIGURE 2). Only 10 to 20% of asthmatic women have symptoms during labor and delivery, and severe asthmatics are more likely to have exacerbation. Asthma exacerbations in pregnant women should be treated similarly to asthma exacerbations in adult patients.⁸

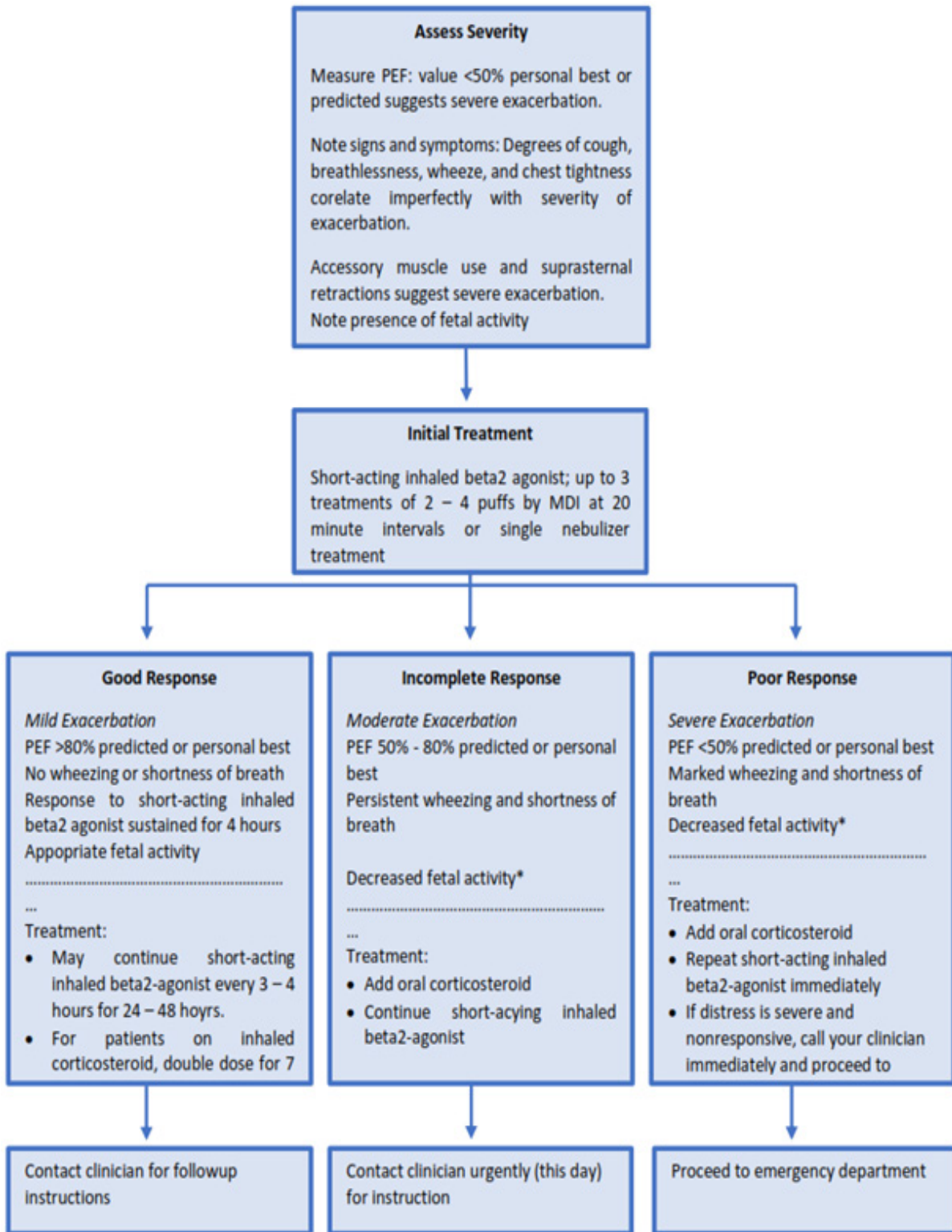


FIGURE 2. Managing asthma exacerbation during pregnancy and lactation at home

TABLE 2. Pregnancy categories for asthma and allergy medication

Agent	FDA pregnancy caterogy	
	B	C
Bronchodilators	Terbutaline Ipratropium bromide	Albuterol Formoterol Epinephrine Theophylline Tiotropium
Inhaled corticoste- roid	Budesonide	Fluticasone Triamcinolone Beclomethasone Mometasone
Oral corticosteroids	-	Methylprednisolone Prednisone Prednisolone Hydrocortisone
Leukotriene receptor antagonist	Zafirlukast Montelukast	-
Leukotriene synthe- sis inhibitor	-	Zileuton
Decongestants	-	Phenyleprine Pseudoephedrine
Antitussives	-	Dextromethorphan
Antihistamines	Loratadine Levocetirizine Cetirizine Chlorpheniramine Diphenhydramine	Fexofenadine Desloratadine Hydroxyzine

CONCLUSION

Exacerbations of asthma, a common pregnancy complication that can lead to a variety of clinical issues. Asthma that is not well-controlled can have significant, even life-threatening implications. Given that nearly half of pregnant women fail to take their asthma prescriptions, improved knowledge of the crucial need of asthma control among physicians caring for women of reproductive age may improve outcomes, particularly through patient education on medication adherence. To treat asthma, a step-by-step therapy approach should be adopted. Clinicians should advise asthmatic pregnant women to avoid asthma triggers, practice proper inhaler technique, take their asthma

medications as prescribed, and seek medical attention as soon as symptoms appear. Despite a paucity of data on the effects of asthma medications on the mother and fetus, they are generally regarded as safe. During pregnancy and breastfeeding, all asthma medications should be continued.

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