

Asthma and Rhinitis During Pregnancy

Jennifer A. Namazy, MD¹ and Michael Schatz, MD²

¹Scripps Clinic, San Diego, CA

²Kaiser Permanente Medical Center, San Diego, CA

OUTLINE

RHINITIS DURING PREGNANCY

Pregnancy Rhinitis
Rhinitis Medicamentosa
Acute Bacterial Rhinosinusitis
Allergic Rhinitis

ASTHMA DURING PREGNANCY

Pathophysiology
Diagnosis
Assessment
Management
Asthma Exacerbations
Follow-Up

CONCLUSION

women. *Mt Sinai J Med* 78:661–670, 2011. © 2011 Mount Sinai School of Medicine

Key Words: asthma, pregnancy, rhinitis.

RHINITIS DURING PREGNANCY

Rhinitis is a very common problem that may occur during pregnancy. One study has suggested that as many as 35% of unselected patients complain of significant nasal symptoms during pregnancy.¹

Rhinitis may be limited to pregnancy, which has been called “vasomotor rhinitis of pregnancy,” or more recently “pregnancy rhinitis.” Pregnancy itself may also have a substantial effect on preexisting rhinitis. In the past, rhinitis and asthma have been evaluated and treated as separate disorders; however, the united airway disease hypothesis proposes that upper and lower airway disease are both manifestations of a single inflammatory process within the respiratory tract. Rhinitis and asthma may worsen, improve, or remain unchanged during pregnancy.² One study found that in

Rhinitis and asthma may worsen, improve, or remain unchanged during pregnancy.

ABSTRACT

Pregnancy may be complicated by new-onset or preexisting rhinitis, or asthma. This article reviews the recognition and management of rhinitis and asthma during pregnancy, as well as general principles of medication use during pregnancy. Asthma is one of the most common potentially serious medical problems to complicate pregnancy, and chronic rhinitis is even more common in pregnant women. Both conditions may substantially affect maternal quality of life and directly or indirectly affect the pregnancy. Optimal management of asthma and rhinitis during pregnancy is thus important for both mother and baby. This article reviews the assessment and management of rhinitis and asthma in pregnant

568 pregnant asthmatics there was concordance between the course of asthma and that of rhinitis during pregnancy.³ Data suggest that rhinitis does not directly affect pregnancy outcome. However, uncontrolled rhinitis can indirectly affect pregnancy by impacting gestational nutrition, sleep, or stress. In addition, uncontrolled rhinitis may be a cause of snoring, which may increase the risk of gestational hypertension, preeclampsia, and intrauterine growth retardation, although not all studies have confirmed this association.^{4–6} Uncontrolled rhinitis may also predispose to sinusitis during pregnancy. In fact,

Address Correspondence to:

Jennifer A. Namazy

Scripps Clinic
San Diego, CA

Email: janamazy@yahoo.com

sinusitis is more common during pregnancy than in women who are not pregnant.⁷ Thus, appropriate management of rhinitis during pregnancy can not only improve patient comfort, but also can help women avoid exposures to other medications, such as antibiotics and oral glucocorticoids.

One of the goals of managing rhinitis during pregnancy includes understanding the differential diagnosis of rhinitis in this group of patients, because treatment options may vary depending on the underlying etiology. The following sections review the most common causes of rhinitis to occur during pregnancy.

Pregnancy Rhinitis

Pregnancy normally induces hyperemia and edema of the nasal mucosa that may lead to vasomotor instability due to vascular pooling. This is likely an effect of fluctuating estrogen and progesterone levels during pregnancy. Women who have this type of rhinitis during pregnancy may have better outcomes than expected, and it has been suggested that the presence of pregnancy rhinitis signals a well-functioning placenta. In one large study, women with pregnancy rhinitis had a decreased risk of perinatal death and intrauterine growth retardation.⁸

Twenty to 30 percent of pregnant women develop symptomatic nasal congestion during pregnancy, a condition now called pregnancy rhinitis.^{1,9,10} Pregnancy rhinitis may be defined as nasal symptoms during pregnancy lasting ≥ 6 weeks, without other signs of respiratory tract infection and with no known allergic cause, disappearing completely within 2 weeks after delivery.¹⁰ Women

Pregnancy rhinitis may be defined as nasal symptoms during pregnancy lasting ≥ 6 weeks, without other signs of respiratory tract infection and with no known allergic cause, disappearing completely within 2 weeks after delivery.

with pregnancy rhinitis complain of persistent nasal congestion, which may be accompanied by watery or viscous clear nasal secretions.¹¹ Nasal congestion can lead to mouth breathing at night and reduced quality of sleep. The other causes of rhinitis discussed below must be excluded.¹²

The pathophysiology of pregnancy rhinitis is not known. In the past, it was attributed to changes in estrogen and/or progesterone, although there is little specific evidence to support this assertion.¹³ One study found higher levels of placental growth hormone in women with pregnancy rhinitis.¹⁴ Smoking and allergic sensitization to dust mite were identified as risk factors for the development of pregnancy rhinitis in one study.¹⁵ However, neither asthma nor hay fever is more common among women who develop pregnancy rhinitis.

Nonpharmacologic treatment options include regular exercise, saline irrigation,¹⁶ raising the head of the bed, and an external nasal dilator.¹⁷ Potential medication management options include topical intranasal decongestants, intranasal corticosteroids, intranasal anticholinergics, and oral decongestants. Topical intranasal oxymetazoline is considered appropriate for use during pregnancy based on the lack of absorption at recommended doses. However, use for >3 days in a row may lead to rhinitis medicamentosa (see below). Intranasal glucocorticoid sprays were not beneficial for pregnancy rhinitis in a randomized trial of 53 women.¹⁸ Anecdotal evidence supports the use of ipratropium bromide (0.03 percent) nasal spray, which is typically administered as 2 sprays to each nostril 3 $\times$ a day, for pregnancy rhinitis associated with substantial rhinorrhea. One placebo-controlled clinical trial has shown that an oral decongestant (phenylpropanolamine) is effective in reducing symptom scores in women with pregnancy rhinitis.¹⁹ Oral decongestants (pseudoephedrine is usually preferred during pregnancy; see below), can be used for severe pregnancy rhinitis, although oral vasoconstrictors should be avoided in the first trimester (see below) and in women with hypertension.

Rhinitis Medicamentosa

Rhinitis medicamentosa refers to rhinitis symptoms resulting from application of topical agents to the nasal mucosa. The most common precipitant is over-the-counter decongestant nasal sprays containing oxymetazoline.

Several days of nasal decongestant use leads to rebound nasal congestion as the medication wears off, prompting patients to increase the dose in an effort to obtain relief of symptoms, and establishing a vicious cycle of nasal congestion and escalating medication use. Treatment involves discontinuation of the nasal decongestant and, in most cases, concomitant treatment with intranasal glucocorticoids.

Acute Bacterial Rhinosinusitis

One study found that acute bacterial rhinosinusitis was more common in pregnant than nonpregnant patients⁷; although this finding has not been confirmed, a high index of suspicion must be maintained for sinusitis during pregnancy because many pregnant women with sinusitis lack classic

One study found that acute bacterial rhinosinusitis was more common in pregnant than nonpregnant patients; although this finding has not been confirmed, a high index of suspicion must be maintained for sinusitis during pregnancy because many pregnant women with sinusitis lack classic clinical findings.

clinical findings. Patients should probably be treated when the clinical diagnosis is suspected.

As in nonpregnant individuals, antibiotics for acute sinusitis are directed against the most likely pathogens, including *H. influenzae*, *M. catarrhalis*, and *S. pneumoniae*. The likelihood of resistance should be considered in antibiotic choice, but acceptable choices in pregnancy include high-dose amoxicillin (typically 1 g 3× daily), amoxicillin-clavulanate, and cefuroxime. In contrast, the fluoroquinolones, tetracycline, and doxycycline should be avoided in pregnancy.

Penicillin-allergic patients can be treated with trimethoprim-sulfamethoxazole or azithromycin.²⁰

Allergic Rhinitis

Allergic rhinitis is usually preexisting, although it may develop or be recognized for the first time

during pregnancy. Patients with allergic rhinitis often report prominent sneezing, nasal pruritus, and watery rhinorrhea, and some have concomitant ocular itching and irritation. Common triggers for allergic

Patients with allergic rhinitis often report prominent sneezing, nasal pruritus, and watery rhinorrhea, and some have concomitant ocular itching and irritation.

rhinitis include dust mites, animal danders, molds, and pollens. Allergen avoidance is an important part of the treatment of allergic rhinitis (Table 1). If skin testing was not performed in the past, then this evaluation should be deferred until after delivery, as skin testing has the potential to induce systemic allergic reactions in highly sensitive patients. In vitro tests for allergen-specific immunoglobulin E are widely available and may be used during pregnancy (see below), although skin testing is more sensitive for the diagnosis of sensitivities to inhaled allergens.

The mainstays of therapy for allergic rhinitis in nonpregnant patients are antihistamines and intranasal glucocorticoids. No important differences in efficacy or safety appear to exist between the various intranasal glucocorticoid preparations. Thus, if a patient is already well controlled on any of the intranasal glucocorticoid preparations, it would be reasonable to continue it during pregnancy. Some clinicians choose budesonide if starting intranasal glucocorticoids for the first time during pregnancy, because it is classified as a category B drug based on reassuring data available for its use as an inhaled preparation.²¹

Antihistamines are less effective for the treatment of allergic rhinitis compared with intranasal glucocorticoids, particularly for the relief of nasal congestion and postnasal drip. Most pregnant women who require antihistamines for allergic rhinitis are most appropriately treated with a second-generation agent, because these drugs are less sedating and

Table 1. Environmental Control Measures to Reduce Exposure to Allergens⁶⁵.

Indoor Allergens	Instructions	Level of Evidence
Animal dander	Remove pet from house; if removal not acceptable, keep pet out of bedroom	Consensus judgment
Dust mites	Encase pillow and mattress with impermeable covers; wash sheets and blankets in hot water weekly	Data from several randomized controlled trials
Cockroaches	Do not leave food or garbage exposed; use poison baits or traps rather than chemical agents, which can aggravate asthma	Few randomized controlled trials

Antihistamines are less effective for the treatment of allergic rhinitis compared with intranasal glucocorticoids, particularly for the relief of nasal congestion and postnasal drip.

have fewer cholinergic side effects compared with first-generation agents.

Among second-generation antihistamines, loratadine (10 mg once daily) and cetirizine (10 mg once daily) may be considered the second-generation antihistamines of choice in pregnancy. There are reassuring human data for both of these drugs in a large number of pregnant patients.²²

First-generation agents are widely available, inexpensive, and can be useful on an as-needed basis and/or before bed. Among the first-generation agents, chlorpheniramine has been recommended as the first-generation antihistamine of choice for use during pregnancy.²³ Intranasal cromolyn sodium may be considered a first-line therapy for mild allergic rhinitis in pregnancy because of its excellent safety profile. Decongestants are vasoconstrictors that are available as both oral preparations and nasal sprays. Decongestant nasal sprays can be used very briefly (eg, ≤ 3 days) for temporary relief of severe nasal congestion, and some reassuring human data exist for use of intranasal oxymetazoline during pregnancy.^{24,25} However, patients should be warned about dependence with prolonged use of decongestant nasal sprays. Oral decongestants are probably best avoided altogether during the first trimester because of a possible increased risk of a rare birth defect, gastroschisis.²⁶ Pseudoephedrine is the agent of choice in the second and third trimesters in women without hypertension.²¹ A possible association between pseudoephedrine and gastroschisis (baseline incidence of 1 in 10,000 births) was raised in a case-control study.²⁷ However, in a later prospective study of >2000 women who had reported use of oral decongestants during pregnancy, no increased risks of teratogenic effects were detected in the group using oral decongestants, which included pseudoephedrine.⁸ A recent study found that women who took oral decongestants during the second or third trimester were less likely to experience preterm delivery compared with nonexposed women.²⁸ Phenylephrine should probably be avoided in pregnancy because of uncertain efficacy and less reassuring data regarding safety.

Saline irrigation is another option for women who experience rhinitis from allergies. One study

reported that intranasal lavage with hypertonic saline significantly reduced the need for daily antihistamines and appeared to be a safe and effective option.²⁹

ASTHMA DURING PREGNANCY

Asthma currently affects approximately 8% of pregnant women,³⁰ making it one of the most common potentially serious medical problems to complicate pregnancy. Although data have been conflicting, the largest and most recent studies have suggested that maternal asthma increases the risk of adverse perinatal outcomes such as perinatal mortality, preeclampsia, preterm birth, and low-birth weight infants. The potential mechanisms responsible

Although data have been conflicting, the largest and most recent studies have suggested that maternal asthma increases the risk of adverse perinatal outcomes such as perinatal mortality, preeclampsia, preterm birth, and low-birth weight infants.

for these outcomes are less clear, but it has been observed that women with severe asthma or poor control of their asthma during pregnancy may have an increased risk of adverse perinatal outcomes.^{31–44} Therefore, it is a concern that <40% of women with “poorly controlled” asthma symptoms reported use of a controller medication during pregnancy.⁴⁵

Pathophysiology

Asthma is an inflammatory disease of the airways that is associated with reversible airway obstruction and airway hyper-reactivity to a variety of stimuli. Although the cause of asthma is unknown, a number of clinical triggering factors can be identified, including viral infections, allergens, exercise, sinusitis, reflux, weather changes, and stress.

Airway obstruction in asthma can be produced by varying degrees of mucosal edema, bronchoconstriction, mucus plugging, and airway remodeling. In acute asthma, these changes can lead to ventilation perfusion imbalance and hypoxia. Although early acute asthma is typically associated with hyperventilation and hypocapnea, progressive acute asthma can cause respiratory failure with associated carbon dioxide (CO₂) retention and acidosis.

Diagnosis

The first step in evaluating a pregnant patient with asthma is to confirm the diagnosis (Table 2). The most common differential diagnosis is dyspnea of pregnancy, which may occur in early pregnancy in approximately 70% of women. This dyspnea

The most common differential diagnosis is dyspnea of pregnancy, which may occur in early pregnancy in approximately 70% of women.

is usually differentiated from asthma by its lack of association with cough, wheezing, or airway obstruction. Asthma is suspected based on the presence of typical symptoms such as wheezing, chest tightness, cough, and associated shortness of breath. The diagnosis is ideally confirmed by the demonstration of reversible airway obstruction, which most commonly is an increase in forced expiratory volume in 1 second (FEV₁) by ≥12% and at least 200 mL after an inhaled short-acting bronchodilator. In nonpregnant patients with normal pulmonary function, asthma can be confirmed by means of methacholine challenge testing. However, this type of testing is not recommended in

Table 2. *Differential Diagnosis of Dyspnea During Pregnancy.*

Asthma
Dyspnea of pregnancy
Reflux esophagitis
Postnasal drainage
Bronchitis
Laryngeal dysfunction
Hyperventilation
Pulmonary edema
Pulmonary embolism

pregnant patients. Thus, therapeutic trials of asthma therapy, such as 2 to 4 weeks of regular inhaled corticosteroids, may be used during pregnancy in patients with possible but unconfirmed asthma.

Assessment

Once the diagnosis of asthma is confirmed, the next step is the assessment of asthma severity (in patients not already on controller therapy) or assessment of control (in patients already on controller therapy) (Table 3). Both severity and control are assessed based on frequency of symptoms, rescue therapy use, nighttime awakenings, degree of interference with normal activity, exacerbations, and pulmonary function. Patients with intermittent asthma have short episodes and use rescue therapy <3× per week, nocturnal symptoms <3× a month, and normal pulmonary function between episodes. Patients with more frequent symptoms or who require daily asthma medications should be considered to have persistent asthma. Several observations do support the hypothesis that uncontrolled asthma increases perinatal risks, whereas controlled asthma reduces these risks.^{46,47}

Several observations support the hypothesis that uncontrolled asthma increases perinatal risks, whereas controlled asthma reduces these risks.

Management

The National Asthma Education and Prevention Program (NAEPP) published guidelines on the management of asthma in 2005.²¹ These guidelines include the following aspects of asthma management: assessment and monitoring of asthma

Table 3. *Assessment of Asthma Control in Pregnant Women*⁶⁵.

Variable	Well-Controlled Asthma	Asthma Not Well Controlled	Very Poorly Controlled Asthma
Frequency of symptoms	≤2 days/week	>2 days/week	Throughout the day
Frequency of nighttime awakening	≤2×/month	1–3 times/week	≥4×/week
Interference with normal activity	None	Some	Extreme
Use of SABA for symptoms control	≤2 days/week	>2 days/week	Several times/day
FEV ₁ or PF (% of the predicted or personal best value)	>80	60–80	<60
Exacerbation requiring use of systemic corticosteroid (n)	0–1 in the past 12 months	≥2 in the past 12 months	≥2 in the past 12 months

Abbreviations: FEV₁, forced expiratory volume in 1 second; PF, peak flow; SABA, short-acting β-agonist.

symptoms, control of factors contributing to asthma severity, patient education, and pharmacologic therapy.

All patients should be educated regarding the relationship between asthma and pregnancy, and they should be taught about self-management, including inhaler techniques, adherence to medication, control of potential triggers, and treatment of increased symptoms (Table 3). In previously untested patients, sensitivity to potential environmental triggers, such as mite, animal dander, mold, and cockroach, should be assessed using in vitro tests (radioallergosorbent test, enzyme-linked immunosorbent assay). Smokers must be encouraged to discontinue smoking, and all patients should try to avoid exposure to environmental tobacco smoke and other potential irritants as much as possible. Effective allergen immunotherapy can be continued during pregnancy, but benefit-risk considerations do not generally favor beginning immunotherapy during pregnancy. Sinusitis and reflux are relatively common comorbidities during pregnancy that may exacerbate asthma. A high index of suspicion should be maintained for sinusitis, for which symptoms and signs during pregnancy may be subtle.⁷ Although reflux is common during pregnancy and may not require pharmacologic treatment, reflux treatment should be considered in symptomatic patients with difficult-to-control asthma during pregnancy or those with very troublesome reflux symptoms.

Medications for asthma are divided into long-term controller medications⁴⁸ that prevent the manifestations of asthma (inhaled corticosteroids [ICS], long-acting β -agonists [LABA], leukotriene modifiers [leukotriene receptor antagonists; LTRA], cromolyn, and theophylline) and rescue therapy (primarily short-acting inhaled β -agonists [SABA]). Evidence of

Medications for asthma are divided into long-term controller medications that prevent the manifestations of asthma (inhaled corticosteroids, long-acting β -agonists, leukotriene modifiers, cromolyn, and theophylline) and rescue therapy (primarily short-acting inhaled β -agonists).

the efficacy of these drugs during pregnancy is largely extrapolated from studies involving patients who

were not pregnant. Short-acting bronchodilators have been associated with some specific malformations, but confounding by severity could explain these associations as well.^{26,48,49} Three large prospective cohort studies have reported reassuring data regarding a lack of relationship of gestational exposure to short-acting bronchodilators (488–1753 exposed women) to prematurity or reduced fetal growth.^{50–52}

Inhaled corticosteroids are the mainstay of controller therapy during pregnancy. Many studies have shown no increased perinatal risks (including preeclampsia, preterm birth, low birth weight, and congenital malformations) associated with ICS.^{50–56} A recent study of >4000 women who used ICS during pregnancy found no increased risk of perinatal mortality associated with ICS use during pregnancy.⁵⁷ Several large studies support the lack of association of ICS use with total or specific malformations.^{48,58,59} One study⁶⁰ has suggested a relationship between high-dose ICS and total malformations, but confounding by severity is a possible explanation, based on the relationships between exacerbations and congenital malformations demonstrated by the same group.⁶¹

Because it has the most published human gestational safety data, budesonide is considered the preferred ICS for asthma during pregnancy. That is not to say that the other ICS preparations are unsafe. Therefore, ICS other than budesonide may be continued in patients who were well controlled by these agents prior to pregnancy, especially if it is thought that changing formulations may jeopardize asthma control.

Reassuring data on the use of cromolyn and theophylline in pregnant women have been published. There are limited (but reassuring) data for use of LTRAs during pregnancy.^{62,63} Data are lacking regarding the gestational use of LABAs, but their inhalational route and the generally reassuring data for SABAs suggest that these agents are probably safe.²¹ Overall, the risks associated with asthma medications in current use are considered to be definitely lower than the risks associated with uncontrolled asthma.

In contrast, oral corticosteroid use was associated with an increased risk of preterm birth^{50,52} and low-birth weight infants⁵⁰ in 52–185 exposed women. An increased risk of orofacial clefts was reported in a meta-analysis of case-control studies,⁶⁴ but this increased risk was not confirmed in a recent large-cohort study.⁵⁹ Because these risks would be less than the potential risks of a severe asthma exacerbation, which include maternal or fetal mortality, oral corticosteroids are recommended when

Table 4. Steps of Asthma Therapy During Pregnancy.

Step	Preferred Controller Medication	Alternative Controller Medication
1	None	NA
2	Low-dose ICS	LTRA, theophylline
3	Medium-dose ICS	Low-dose ICS+either LABA, LTRA, or theophylline
4	Medium-dose ICS+LABA	Medium dose ICS+LTRA or theophylline
5	High-dose ICS+LABA	NA
6	High-dose ICS+LABA+oral prednisone	NA

Abbreviations: ICS, inhaled corticosteroid; LTRA, leukotriene-receptor antagonist; LABA, long-acting β -agonist; NA, not applicable.

indicated for the management of severe asthma during pregnancy.²¹

Controller therapy should be increased in steps (Table 4) until adequate control is achieved. A 2-step increase, a course of oral corticosteroids, or both should be recommended for women whose asthma is very poorly controlled. Once control is achieved and sustained for several months, consideration of a step down to less-intensive therapy to identify the minimum therapy necessary to maintain control is recommended in nonpregnant patients. In pregnant asthmatic women, this should be done carefully (or possibly not at all for patients with difficult-to-control or labile disease) so as to avoid compromising the patient’s asthma control.²¹ Monthly visits to assess asthma control are recommended for women who require controller therapy during pregnancy. This

Monthly visits to assess asthma control are recommended for women who require controller therapy during pregnancy.

assessment may be performed as part of routine obstetrical visits or by the primary care physician or asthma specialist who is managing the patient’s asthma. Patients with very poorly controlled asthma should be seen every 1 to 2 weeks until control is achieved.

Asthma Exacerbations

A major goal of chronic asthma management is the prevention of asthma exacerbations. These are defined as acute or subacute episodes of progressively worsening shortness of breath,

cough, wheezing, or chest tightness associated with decreases in expiratory airflow. When severe increased asthma symptoms do not respond to home therapy, acute management with higher-dose inhaled β -agonists, inhaled anticholinergics, and systemic corticosteroids is indicated. Intensive fetal monitoring as well as maternal monitoring is essential under these circumstances. In addition to pharmacologic therapy, supplemental oxygen should be administered, adjusting fraction of inspired oxygen to maintain oxygen partial pressure (pO₂) at ≥ 70 kPa and/or O₂ saturation by pulse oximetry $>95\%$. Intravenous fluids (containing glucose if the patient is not hyperglycemic) should also be administered, initially at a rate of ≥ 100 mL/hour.

When severe increased asthma symptoms do not respond to home therapy, acute management with higher-dose inhaled β -agonists, inhaled anticholinergics, and systemic corticosteroids is indicated.

Systemic corticosteroids are recommended for patients who do not respond well (FEV₁ or peak expiratory flow rate [PEFR] $\geq 70\%$ predicted) to the first β -agonist treatment as well as for patients who have recently taken systemic steroids and for those who present with severe exacerbations (FEV₁ or PEFR $\leq 50\%$ predicted). Patients with good responses to emergency therapy (FEV₁ or PEFR $\geq 70\%$ predicted) can be discharged home, generally on SABAs (2–4 puffs every 4 hours as needed) and oral corticosteroids (40–60 mg in a single dose or 2 divided doses for 3–10 days). Inhaled corticosteroids should also be continued or initiated upon discharge until review at medical follow-up. Outpatient follow-up should be arranged within 5 days of the acute visit. Hospitalization should be considered for patients with an incomplete pulmonary function response (FEV₁ or PEFR $\geq 50\%$ but $<70\%$ predicted), pO₂ $< 95\%$ on ambient air, persistent symptoms, or if there is evidence of fetal compromise. Admission to an intensive care unit should be considered for patients with persistent FEV₁ or PEFR $< 50\%$ predicted, pCO₂ > 42 , or sensorium changes. Intubation and mechanical ventilation may be required for patients whose condition deteriorates or fails to improve associated with decreasing pO₂, increasing pCO₂, progressive respiratory acidosis, declining mental status, or increasing fatigue.

Follow-Up

Careful follow-up by physicians experienced in managing asthma is an essential aspect of optimal gestational asthma management. Asthmatic women requiring regular medication should be evaluated at least monthly. In addition to the history and physical exam, objective measure of respiratory status (ideally spirometry) should be obtained on every clinic visit. In addition, patients with more severe or labile asthma should be considered for home peak expiratory flow monitoring. All pregnant patients should have a written action plan that directs their home therapy of asthma exacerbations, and facilitated access to their physician for uncontrolled symptoms.

In addition to the history and physical exam, objective measures of respiratory status (ideally spirometry) should be obtained on every clinic visit. In addition, patients with more severe or labile asthma should be considered for home peak expiratory flow monitoring.

CONCLUSION

Rhinitis and asthma are both common medical problems that may worsen during pregnancy. In addition to affecting maternal quality of life, uncontrolled rhinitis may indirectly affect fetal health, and uncontrolled asthma may directly lead to adverse perinatal outcomes. Awareness of proper diagnosis and treatment options for rhinitis and asthma during pregnancy is important for those caring for pregnant patients.

DISCLOSURES

Potential conflict of interest: Nothing to report.

REFERENCES

- Gani F, Braid A, Lombardi C, et al. Rhinitis in pregnancy. *Eur Ann Allergy Clin Immunol* 2003; 35: 306–313.
- Schatz M, Zeiger R. Diagnosis and management of rhinitis during pregnancy. *Allergy Proc* 1988; 9: 545–554.
- Kircher S, Schatz M, Long L. Variables affecting asthma course during pregnancy. *Ann Allergy Asthma Immunol* 2002; 89: 463–466.
- Ayrim A, Keskin E, Ozol D, et al. Influence of self-reported snoring and witnessed sleep apnea on gestational hypertension and fetal outcome in pregnancy. *Arch Gynecol Obstet* 2011; 283: 195–199.
- Franklin K, Holmgren PA, Jönsson F, et al. Snoring, pregnancy-induced hypertension, and growth retardation of the fetus. *Chest* 2000; 117: 137–141.
- Somoskövi A, Bártfai Z, Tamási L, et al. Population-based case-control study of allergic rhinitis during pregnancy for birth outcomes. *Eur J Obstet Gynecol Reprod Biol* 2007; 131: 21–27.
- Sorri M, Hartikainen-Sorri AL, Kärjä J. Rhinitis during pregnancy. *Rhinology* 1980; 18: 83–86.
- Källén BA, Olausson P. Use of oral decongestants during pregnancy and delivery outcome. *Am J Obstet Gynecol* 2006; 194: 480–485.
- Ellegård EK. The etiology and management of pregnancy rhinitis. *Am J Respir Med* 2003; 2: 469–475.
- Ellegård E, Hellgren M, Torén K, et al. The incidence of pregnancy rhinitis. *Gynecol Obstet Invest* 2000; 49: 98–101.
- Ellegård EK. Pregnancy rhinitis. *Immunol Allergy Clin North Am* 2006; 26: 119–135.
- Ellegård EK. Clinical and pathogenetic characteristics of pregnancy rhinitis. *Clin Rev Allergy Immunol* 2004; 26: 149–159.
- Ellegård EK, Karlsson N, Ellegård LH. Rhinitis in the menstrual cycle, pregnancy, and some endocrine disorders. *Clin Allergy Immunol* 2007; 19: 305–321.
- Ellegård EK, Oscarsson J, Bougoussa M, et al. Serum level of placental growth hormone is raised in pregnancy rhinitis. *Arch Otolaryngol Head Neck Surg* 1998; 124: 439–443.
- Ellegård EK, Karlsson NG. IgE-mediated reactions and hyperreactivity in pregnancy rhinitis. *Arch Otolaryngol Head Neck Surg* 1999; 125: 1121–1125.
- Rabago D, Zgierska A. Saline nasal irrigation for upper respiratory conditions. *Am Fam Physician* 2009; 80: 1117–1119.
- Turnbull GL, Rundell O, Rayburn WF, et al. The external nasal dilator. *J Reprod Med* 1996; 41: 897–902.
- Ellegård EK, Hellgren M, Karlsson NG. Fluticasone propionate aqueous nasal spray in pregnancy rhinitis. *Clin Otolaryngol Allied Sci* 2001; 26: 394–400.
- Toll K, Graf P. Phenylpropylamine's decongestive effect on the nasal mucosa of pregnant women with nasal stuffiness. *Rhinology* 2006; 44: 274–278.
- Laibl V, Sheffield J. The management of respiratory infections during pregnancy. *Immunol Allergy Clin North Am* 2006; 26: 155–172.
- Busse WW, National Asthma Education and Prevention Program expert panel report. Managing asthma during pregnancy: recommendations for pharmacologic treatment—2004 update [published correction appears in *J Allergy Clin Immunol* 2005; 115: 477]. *J Allergy Clin Immunol* 2005; 115: 34–46.
- Källén B. Use of antihistamine drugs in early pregnancy and delivery outcome. *J Matern Fetal Neonatal Med* 2002; 11: 146–152.
- Schatz M, Petitti D. Antihistamines and pregnancy. *Ann Allergy Asthma Immunol* 1997; 78: 157–159.
- Rayburn WF, Anderson J, Smith CV, et al. Uterine and fetal Doppler flow changes from a single dose of

- a long-acting intranasal decongestant. *Obstet Gynecol* 1990; 76: 180–182.
25. Heinonen O, Slone D, Shapiro S. *Birth Defects and Drugs in Pregnancy*. Littleton, MA: Publishing Sciences Group; 1977.
 26. Lin S, Munsie JP, Herdt-Losavio ML, et al.; National Birth Defects Prevention Study. Maternal asthma medication use and the risk of gastroschisis. *Am J Epidemiol* 2008; 168: 73–79.
 27. Werler MM, Mitchell AA, Shapiro S. First trimester maternal medication use in relation to gastroschisis. *Teratology* 1992; 45: 361–367.
 28. Hernandez RK, Mitchell AA, Werler MM. Decongestant use during pregnancy and its association with preterm delivery. *Birth Defects Res A Clin Mol Teratol* 2010; 88: 715–721.
 29. Garavello W, Somigliana E, Acaia B, et al. Nasal lavage in pregnant women with seasonal allergic rhinitis: a randomized study. *Int Arch Allergy Immunol* 2010; 151: 137–141.
 30. Kwon HL, Belanger K, Bracken MB. Asthma prevalence among pregnant and childbearing-aged women in the United States: estimates from national health surveys. *Ann Epidemiol* 2003; 13: 317–324.
 31. Stenius-Aarniala B, Piirila P, Teramo K. Asthma and pregnancy: a prospective study of 198 pregnancies. *Thorax* 1988; 43: 12–18.
 32. Perlow JH, Montgomery D, Morgan MA, et al. Severity of asthma and perinatal outcome. *Am J Obstet Gynecol* 1992; 167(4 part 1): 963–967.
 33. Lao TT, Huengsborg M. Labour and delivery in mothers with asthma. *Eur J Obstet Gynecol Reprod Biol* 1990; 35: 183–190.
 34. Lehrer S, Stone J, Lapinski R, et al. Association between pregnancy-induced hypertension and asthma during pregnancy. *Am J Obstet Gynecol* 1993; 168: 1463–1466.
 35. Sims BA, Kelly JG, Shanks RG. A comparison of plasma levels of theophyllinates after oral administration. *Br J Clin Pharmacol* 1976; 3: 194–196.
 36. Corchia C, Bertollini R, Forastiere F, et al. Is maternal asthma a risk factor for low birth weight? Results of an epidemiologic survey. *Eur J Epidemiol* 1995; 11: 627–631.
 37. Demissie K, Marcella SW, Breckenridge MB, et al. Maternal asthma and transient tachypnea of the newborn. *Pediatrics* 1998; 102(1 part 1): 84–90.
 38. Demissie K, Breckenridge MB, Rhoads GG. Infant and maternal outcomes in the pregnancies of asthmatic women. *Am J Respir Crit Care Med* 1998; 158: 1091–1095.
 39. Källén B, Rydhstroem H, Aberg A. Asthma during pregnancy—a population based study. *Eur J Epidemiol* 2000; 16: 167–171.
 40. Liu S, Wen SW, Demissie K, et al. Maternal asthma and pregnancy outcomes: a retrospective cohort study. *Am J Obstet Gynecol* 2001; 184: 90–96.
 41. Sorensen TK, Dempsey JC, Xiao R, et al. Maternal asthma and risk of preterm delivery. *Ann Epidemiol* 2003; 13: 267–272.
 42. Acs N, Puho E, Banhid F, et al. Association between bronchial asthma in pregnancy and shorter gestational age in a population-based study. *J Matern Fetal Neonatal Med* 2005; 18: 107–112.
 43. Sheiner E, Mazor M, Levy A, et al. Pregnancy outcome of asthmatic patients: a population-based study. *J Matern Fetal Neonatal Med* 2005; 18: 237–240.
 44. Tamási L, Somoskövi A, Müller V, et al. A population-based case-control study on the effect of bronchial asthma during pregnancy for congenital abnormalities of the offspring. *J Asthma* 2006; 43: 81–86.
 45. Louik C, Schatz M, Hernández-Díaz S, et al. Asthma in pregnancy and its pharmacologic treatment. *Ann Allergy Asthma Immunol* 2010; 105: 110–117.
 46. Schatz M, Dombrowski MP, Wise R, et al. Spirometry is related to perinatal outcomes in pregnant women with asthma. *Am J Obstet Gynecol* 2006; 194: 120–126.
 47. Bakhireva LN, Schatz M, Jones KL, et al. Asthma control during pregnancy and the risk of preterm delivery or impaired fetal growth. *Ann Allergy Asthma Immunol* 2008; 101: 137–143.
 48. Källén B, Otterblad Olausson P. Use of anti-asthmatic drugs during pregnancy. 3. Congenital malformations in the infants. *Eur J Clin Pharmacol* 2007; 63: 383–388.
 49. Lin S, Herdt-Losavio M, Gensburg L, et al. Maternal asthma medication use and the risk of congenital heart defects. *Birth Defects Res A Clin Mol Teratol* 2009; 85: 161–168.
 50. Schatz M, Dombrowski MP, Wise R, et al. The relationship of asthma medication use to perinatal outcomes. *J Allergy Clin Immunol* 2004; 113: 1040–1045.
 51. Schatz M, Zeiger RS, Harden K, et al. The safety of asthma and allergy medications during pregnancy. *J Allergy Clin Immunol* 1997; 100: 301–306.
 52. Bracken MB, Triche EW, Belanger K, et al. Asthma symptoms, severity, and drug therapy: a prospective study of effects on 2205 pregnancies. *Obstet Gynecol* 2003; 102: 739–752.
 53. Norjavaara E, de Verdier MG. Normal pregnancy outcomes in a population-based study including 2,968 pregnant women exposed to budesonide. *J Allergy Clin Immunol* 2003; 111: 736–742.
 54. Källén B, Rydhstroem H, Aberg A. Congenital malformations after the use of inhaled budesonide in early pregnancy. *Obstet Gynecol* 1999; 93: 392–395.
 55. Bakhireva LN, Jones KL, Schatz M, et al. Organization of Teratology Information Services Research Group. Asthma medication use in pregnancy and fetal growth. *J Allergy Clin Immunol* 2005; 116: 503–509.
 56. Martel MJ, Rey E, Beauchesne MF, et al. Use of inhaled corticosteroids during pregnancy and risk of pregnancy induced hypertension: nested case-control study. *BMJ* 2005 Jan 29; 330: 230.
 57. Breton MC, Beauchesne MF, Lemièrre C, et al. Risk of perinatal mortality associated with inhaled corticosteroid use for the treatment of asthma during pregnancy. *J Allergy Clin Immunol* 2010; 126: 772–777 e2.
 58. Blais L, Beauchesne MF, Rey E, et al. Use of inhaled corticosteroids during the first trimester of pregnancy and the risk of congenital malformations among women with asthma. *Thorax* 2007; 62: 320–328.
 59. Hviid A, Mølgaard-Nielsen D. Corticosteroid use during pregnancy and the risk of orofacial clefts. *CMAJ* 2011; 183: 796–804.
 60. Blais L, Beauchesne MF, Lemièrre C, et al. High doses of inhaled corticosteroids during the first trimester of pregnancy and congenital malformations. *J Allergy Clin Immunol* 2009; 124: 1229–1234 e4.
 61. Blais L, Forget A. Asthma exacerbations during the first trimester of pregnancy and the risk of congenital malformations among asthmatic women. *J Allergy Clin Immunol* 2008; 121: 1379–1384.

62. Sarkar M, Koren G, Kalra S, et al. Montelukast use during pregnancy: a multicentre, prospective, comparative study of infant outcomes. *Eur J Clin Pharmacol* 2009; 65: 1259–1264.
63. Bakhireva LN, Jones KL, Schatz M, et al. Safety of leukotriene receptor antagonists in pregnancy. *J Allergy Clin Immunol* 2007; 119: 618–625.
64. Park-Wyllie L, Mazzotta P, Pastuszak A, et al. Birth defects after maternal exposure to corticosteroids: Prospective cohort study and meta-analysis of epidemiologic studies. *Teratology* 2000; 62: 385–392.
65. Schatz M, Dombrowski MP. Clinical practice: asthma in pregnancy. *N Engl J Med* 2009; 360: 1862–1869.

Copyright of Mount Sinai Journal of Medicine is the property of Wiley-Blackwell and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.