Asthma Management and Prevention in Pregnancy, Labour and Birth

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ABSTRACT

Asthma is one of the most common medical disorders among pregnant women and the prevalence of asthma has been increasing due to rising obesity rates and an increase in urban pollutants. Numerous physiological, lifestyle and environmental factors influence the course of asthma in pregnancy. Management of asthma in pregnancy includes education, monitoring and treatment. Under-treated or poorly controlled asthma poses the biggest risk to mother and baby. Midwives in particular have a role to play in asthma prevention by educating women about the importance of the links between medication, maternal nutrition in pregnancy and the potential risk of future asthma in the child.

KEY WORDS

asthma, pregnancy, corticosteriod, maternal nutrition

INTRODUCTION

Asthma is one of the most common medical disorders for women of childbearing age with a prevalence rate of approximately 6% among Canadian pregnant women.[1] Increasing levels of environmental pollutants and rising obesity rates may be responsible for an increase in asthma prevalence over the last several decades.[2,3] Asthma is characterized by an over responsive respiratory system leading to chronic inflammation of the airways. It is associated with chest tightness, wheezing, cough, edema and hyperactive mucous production.[4,5] Asthma sufferers often notice a worsening of symptoms at night. There are four main classifications of asthma severity: 1) mild intermittent, 2) mild persistent, 3) moderate persistent, and 4) severe persistent (see Table 1). Asthma is classified as an atopic disease when the symptoms are precipitated by allergens or other extrinsic factors such as cigarette smoke or pollutants.

Treatment for asthma in pregnancy includes patient education, monitoring, and medications with the ultimate goal of reducing hypoxemic episodes in the mother, and thereby ensuring adequate oxygenation of the baby. There is also a growing body of evidence pointing to the relationship between maternal nutrition in the prenatal period and the risk of future asthma in the child.[3]

Asthma in the Pregnant Woman

Many respiratory changes occur in pregnancy in response to the increased metabolic and respiratory demands of the fetus. The maternal resting minute ventilation increases by 40-50% due to a rise in tidal volume rather than a rise in respiratory rate.[5] A mild respiratory alkalosis results from this state of hyperventilation, which is a normal adaptation to pregnancy.[6] It is difficult to predict how asthma will respond to pregnancy. Approximately 1/3 of pregnant women report an improvement in asthma

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symptoms during pregnancy while 1/3 report worsening symptoms.[7] A systematic review of the effect of pregnancy on asthma, which used objective rather than subjective measures of asthma severity, found that bronchial hyperresponsiveness improved between preconception and pregnancy in 69% of women, although it deteriorated in 31% of women.[8] The second trimester was the point of greatest improvement, and women who were the most hyperresponsive initially saw the greatest improvement. These improvements generally reverted back to pre-pregnancy levels by one month after birth.

Progesterone mediated bronchodilation and increased serum cortisol levels are some of the physiological changes likely to improve asthma during pregnancy, while increased stress and gastro-oesophageal reflux may aggravate the condition by causing increased bronchoconstriction.[5] Increased susceptibility to viral infection as a result of cell-mediated immunosuppression may also precipitate asthma symptoms in pregnancy.[8]

The sex of the fetus is another potential influence on the course of asthma in pregnancy. In a study of asthmatic women in pregnancy, those pregnant with girls were more likely to experience an increase in asthma symptoms during pregnancy,[9] likely due to the male fetus emitting a minute surge of androgens around 12-16 weeks. A large prospective cohort study found rates of asthma exacerbation in pregnant women to be directly proportional to the degree of pre-pregnancy severity.[10] Women with mild asthma had a rate of exacerbations of 12.6% and a hospitalization rate of 2.3% while the women with severe asthma had an exacerbation rate of 51.9% and a hospitalization rate of 26.9%. Obesity is an important influence on the course of asthma in pregnant women. There is a well-known association between obesity and asthma. Women with asthma are, as a group, heavier than women without asthma and the risk of developing asthma increases with BMI.[3] Obesity is associated with an increased risk of asthma exacerbations during pregnancy and may also affect response to asthma medications.[11]

The link between respiratory diseases such as asthma and environmental pollutants is well established. However, with the number different pollutants and chemicals in our homes and external environments it has been difficult to establish a cause and effect relationship for each exposure. Environmental exposure and asthma is due to the interaction of numerous physical, mechanical, and genetic factors. A person with a genetic susceptibility to asthma responds to a particular pollutant or allergen by producing a specific IgE antibody following exposure. Once sensitized they become susceptible to acute asthma episodes in response to very small exposures to airborn allergens. Dust mites, ozone, nitrogen dioxide are some environmental exposures that affect asthma in pregnancy. Studies have found that children and adults in urban areas are at greater risk of developing asthma and experience more morbidity from the disease.[12,13] Global warming and living near traffic sources is also associated with asthma occurrence and exacerbations[14] by making the environment more amenable to dust mites,

Table 1: *Classifications of asthma severity and preferred drug treatment in pregnancy*

Classification:	Symptoms:
Mild intermittent	• Symptoms < 2days a week, < 2 nights a month • No daily medication needed, a course of inhaled corticosteroid may be used • Occasional severe exacerbation may occur separated by long periods of normal lung function and no symptoms
Mild persistent	• Symptoms >2 days /week but < daily, > 2 nights/ month • Low-dose inhaled corticosteroid preferred medication
Moderate persistent	• Symptoms daily and > 1 night/week • Treated with medium-dose corticosteroid and/or combined with a long-acting beta-agonist
Severe persistent	• Symptoms continuous during the day, with frequent night-time symptoms • Treated with high-dose corticosteroid or oral corticosteroid and long-acting beta-agonist

increasing allergens such as pollens in the environment, and causing smog levels to rise.

Approximately one-half of the adult asthmatic population are current or former cigarette smokers.[15] Tobacco smoke interacts with asthma to cause more severe symptoms, accelerate lung pathology and impair therapeutic response to asthma medications such as corticosteroids. Smoking also creates resistance to corticosteroid medications that may not reverse with smoking cessation. [15] Since smoking has an association with many pregnancy complications such as low-birth weight, preterm labour, and stillbirth, pregnant asthmatic women who smoke are particularly vulnerable to poor outcomes.[16]

The Effect of Asthma on Pregnancy Outcomes

The literature on the effect of asthma on pregnancy is inconsistent and many studies suffer from methodological flaws including low power, lack of control for confounders, and failure to stratify by asthma severity, control and management. In addition, the episodic nature of asthma means that some women with a diagnosis of asthma may not have symptoms during pregnancy while other women, without an asthma diagnosis, will develop symptoms while pregnant. Some studies have found an increase in the risk of premature labour and low birth weight[18] and an increased risk of gestational hypertension and pre-eclampsia.[17] The risk of these outcomes is generally related to the degree of asthma control. Maintaining good control throughout pregnancy helps to keep these risks to a minimum. Women with severe, uncontrolled asthma are at highest risk of a number of adverse outcomes and should be followed closely in pregnancy by a physician or maternal-fetal medicine specialist. Table 2 describes the features of well-controlled asthma.

Many of the complications of asthma in pregnancy are confounded by the co-morbidity of obesity. Hendler et al. compared the rates of pulmonary and non-pulmonary pregnancy complications in obese and non-obese asthmatic pregnant women and found that the increased rate of non-pulmonary complications of pregnancy (cesarean section, pre-eclampsia, gestational hypertension, and gestational diabetes) were associated with obesity and not with asthma status.[11] Triche et al. found that frequent asthma symptoms throughout pregnancy were associated with an increased risk of pre-eclampsia while simply having a diagnosis of asthma did not increase the risk.[17] Smoking status is another important confounder to consider as it has an impact on both asthma morbidity and perinatal outcome. Smoking is found more frequently among asthmatic women than in the non-asthmatic population.[15]

Asthma Management

Treatment for asthma in pregnancy includes client education, monitoring, and medication with the goal of reducing hypoxemic episodes in the mother, ensuring adequate oxygenation of both mother and fetus. The most important factor contributing to a worsening of asthma symptoms in pregnancy is failure to take medication, usually due to fears about safety for the fetus.[5,17,19] Pregnant women with asthma should be reassured about the safety of the majority of asthma medications. It should be stressed that it is safer to be exposed to the medication than to have asthma symptoms in pregnancy.[5,19] There are two main categories of

Table 2: *Features of well-controlled asthma (adapted from NAEPP Expert Panel, 2005)*

Controlled asthma is defined as:

- Minimal or no chronic symptoms day or night
- Minimal or no exacerbations
- No limitations on activities
- Maintenance of (near) normal pulmonary function
- Minimal use of short-acting inhaled beta$_2$-agonists
- Minimal or no adverse effects of medications

asthma medications: long-term maintenance medication, generally a low-dose inhaled corticosteroid, and short-term "rescue" medications, generally an inhaled beta 2 agonists such as salbutamol. The inhaled corticosteroid of choice in pregnancy is budesonide because it has the best safety record and the largest dataset on its use in pregnancy.[20] Other inhaled corticosteroids are thought to be safe but have smaller datasets in the pregnant population. Inhaled corticosteroids are known to help prevent acute asthma exacerbations in pregnancy and women should be encouraged to continue using them. Failure to use inhaled corticosteroids has been associated with an increased risk of low birth weight.[19]

Inhaled beta 2 agonists (salbutamol) are recommended as short-term rescue medications for the rapid relief of acute bronchospasm. If a pregnant woman uses rescue medication more than twice per week this indicates a need for additional maintenance medication (inhaled corticosteroid).[19] The use of inhaled beta 2 agonists have not been linked to any adverse maternal or fetal outcome, however, reliance on beta 2 agonists alone has been linked to increases in mortality in the non-pregnant asthmatic population.[19] Oral corticosteroids are used more frequently in women with severe persistent asthma. Their use in pregnancy had been associated with an increase in preterm delivery, pre-eclampsia, and low birth weight.[19]

One study has found an association between oral corticosteroid use, particularly in the first trimester, and isolated cleft lip with or without cleft palate.[5] The length of exposure, timing and dose of the drug was not well described. Oral corticosteroids are generally used for severe asthma exacerbations making it difficult to separate the effects of severe asthma to the effect of the medication. Other adverse effects associated with oral corticosteroid use in pregnancy include an increased risk of infection and reduced glucose tolerance leading to an increase in gestational diabetes.[5] Regular monitoring of blood glucose is recommended for all women taking oral corticosteroids.

There is a growing body of evidence pointing to the relationship between maternal nutrition in the prenatal period and the risk of future asthma in the child.

Acute asthma exacerbations in pregnancy are a medical emergency and require immediate evaluation in hospital. Management includes consultation with obstetrics, maternal-fetal medicine, and possibly respiratory specialist. Supplemental oxygen should be given and O2 saturations should be kept >95%.[19] Women should be encouraged to use their rescue inhaler. Mental status changes, maternal exhaustion, respiratory acidosis or fetal distress may indicate a need for immediate delivery.[19]

Women can be reassured that a serious asthma attack in labour is extremely rare, especially if asthma is well-controlled. Regular inhaled asthma medications can continue to be used throughout labour.[5] Most forms of pain relief may be used safely with asthmatic women in labour, including epidural analgesia and Entonox.[5] If an asthma attack develops in labour opiods such as morphine and meperidine should be avoided because they can cause the release of histamine and worsen the attack.[5] If anaesthesia is required for caesarean section, general anaesthesia should be avoided due to the increased risk of chest infection associated with atelectasis, the collapse of part or all of a lung by blockage of the air passages.

Ergot and prostaglandin $F_{2\alpha}$ (Carboprost/Hemabate) should be avoided for the treatment of postpartum haemorrhage as these agents can cause bronchospasm.[5,21] Misoprostol is a more appropriate second-line drug for the management of post-partum hemorrhage in asthmatic women. Prostaglandin E_2, used for induction of labour, is a bronchodilator and is *not* contra-indicated for asthmatic women.[5] Some women with asthma may not

tolerate non-steroidal anti-inflammatory drugs (such as Asprin, Ibuprofen, Motrin, Voltaren) which may be a consideration post-delivery.[5, 19]

Women with asthma should be encouraged to breastfeed their infants. Oddy et al. found a significant reduction in the risk of childhood asthma at six years of age if exclusive breastfeeding was continued for at least four months after birth.[22] On the other hand, there is some evidence that prolongued exclusive breastfeeding (greater than nine months) increases the risk of allergic diseases, so it appears the optimal time for introducing solids is between four and nine months.[23] Breastfeeding also provides pathogen-specific IgG or IgA antibodies which are the primary protection for the immature immune system of the infant. Breast milk also provides the necessary products for the colonization and maturation of the infant's gastrointestinal tract and its immune defense mechanisms. [23] The potential benefits of this early gut colonization are described below.

Asthma Prevention

Many pregnant asthmatic women seek advice about preventing asthma and allergies in their baby. There is a growing body of evidence pointing to the relationship between maternal nutrition in the prenatal period and the risk of future asthma in the child. A recent study examined the role of maternal nutrition, prenatal exposure to specific nutrients, as well as patterns of colonization of the neonatal and infant gut and their role in the development of both asthma and obesity.[3] Levels of vitamin D, essential fatty acids, antioxidants (such as vitamin C and vitamin E), and trace elements (in particular magnesium and selenium) seem to have a protective effect on the future development of asthma in the child. Limited trials of supplementation with these vitamins in adulthood have not shown significant improvements in asthma status suggesting that the critical period may be in pregnancy when the immune system and lungs are developing.

Although our understanding of the early colonization of the infant gut is incomplete, studies have suggested the importance of gut flora in the development of allergic diseases such as asthma. Antibiotic administration in labour and/or in the early neonatal period (up to six months of age) is an independent risk factor for the development of allergies and asthma in children.[23,24] It is thought that the disturbance of the normal patterns of gut colonization by antibiotic sterilization lead to a poor functioning of the gut immune system. The association between obesity and asthma supports the gut colonization hypothesis. The high-fat diet and sedentary lifestyle that accompany obesity influence the composition of gut microflora, reducing the number of beneficial bacteria, such as lactobacilli and bifidobacteria.[3] The "hygiene

Table 3: *Complete medical history in pregnant women with asthma*

- Midwives should inquire about the following medical history in a pregnant woman with asthma:
  - Age of onset of asthma
  - Frequency and severity of symptoms (both daytime and nighttime)
  - Triggers (such as allergens, exercise, odours, cold air, hormonal changes, etc.)
  - Triggers in the home environment (carpets, pets, age of home, proximity to traffic, etc)
  - Seasonal variation in symptoms
  - Past and present treatments (maintenance as well as rescue medications)
  - If multiparous, course of asthma in previous pregnancies
  - Family history, including other children with asthma
  - Allergies (food and environmental)
  - Drug sensitivities or allergies (i.e. NSAIDS such as aspirin and ibuprofen and beta-blockers such as propranolol)
  - Smoking and/or exposure to second hand smoke
  - Gastroesophageal reflux symptoms
  - Body Mass Index (BMI)

hypothesis" proposes that exposure to beneficial bacteria promotes the development of a healthy immune system which is protective against asthma and other allergic diseases.

A recent study that found a moderately increased risk of asthma in children delivered by caesarean section (CS).[25] Birth by CS was associated with a 52% increased risk of asthma compared to spontaneous vaginal birth. However, the authors point out that CS has also been associated with increased risk of respiratory distress syndrome and transient tachypnea of the newborn, both of which have been linked to the development of asthma. Another confounding factor is the association between caesarean birth and lower breastfeeding rates.

Pregnancy is often a period of high motivation in terms of making healthy lifestyle changes.

Midwifery Care for Pregnant Women with Asthma

The frequency of prenatal care provides an ideal opportunity to reinforce the need for asthma control or perhaps even diagnose the disease. During the initial physical exam midwives should inquire about respiratory symptoms of asthma such as shortness of breath, chest tightness, wheezing and persistent cough. On auscultation of the chest, wheezing and crackles can obscure breath sounds. In asthma wheezes are most commonly heard on expiration. [26] Any abnormal finding during the physical exam or a history of moderate to severe asthma is cause for a consultation with a physician.[27]

Women with a history of medicated asthma must continue to have it monitored by their physicians. Midwives can inquire about the frequency and type of asthma symptoms and the use of asthma medications. Women should be encouraged to see their physicians should they experience any worsening of symptoms. In addition, midwives can reassure women that it is safer to continue with asthma medication and control the disease than to have asthma symptoms worsen during pregnancy. Inhaled corticosteroids for maintenance therapy are superior to over-use of rescue medications. Women with mild asthma can be reassured that they are unlikely to experience problems in pregnancy, labour or birth and their asthma is unlikely to impact fetal outcomes provided it is kept well controlled. Knowing the classification of a women's asthma in pregnancy can be important for predicting her risk of severe exacerbations and hospitalization and determining if she is suitable for midwifery care.

Women with mild intermittent asthma that is well controlled can be safely cared for by midwives. Women with moderate or severe persistent asthma will likely be under the care of a pulmonologist but referral should also be made to a maternal-fetal medicine specialist for pregnancy care. Women who are using allergy immunotherapy shots with good effect may continue with the shots in pregnancy.[28] Due to the risk of anaphylaxis, beginning allergen immunotherapy in pregnancy is not recommended. Midwives can support good nutrition with attention to sources of vitamin D, essential fatty acids, antioxidants and trace elements as well as encouraging moderate exercise. All pregnant women should be encouraged to stop smoking, especially those women with a history of asthma. Pregnancy is often a period of high motivation in terms of making healthy lifestyle changes. Midwives can facilitate these changes by making resources and referrals available.

Asthmatic pregnant women should be aware of the effect of environmental pollutants (smog) on their breathing. They should be encouraged to check their local air quality index and avoid exercising outdoors on days when the air quality is poor. Home environments may also contain triggers and pregnant women may need to consider making changes to reduce their exposure such as removing carpets, getting rid of pets and/or purchasing an air filter. Discussion of preventative measures for post partum hemorrhage, such as active management of

the third stage with oxytocin, may be warranted given the fact that many of the second line treatments for post partum hemorrhage are contraindicated.

With increasing environmental pollutants and a rise in the prevalence of obesity midwives are likely to see an increase in the number of women presenting to their clinics with asthma. Awareness of the importance of education, referral, monitoring and treatment for asthmatic pregnant women will ensure the best possible outcomes for those women in midwifery care. Midwives are also well placed to educate women on strategies to reduce risks and eliminate household triggers.

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ON THE FRONT COVER
La Gravida (The Pregnant Woman)
Raphael c.1507
Oil on Wood
26 x 20.5 inches
Location: Florence, Pitti Palace
Artwork courtesy of
Art Resource, New York