The impact of pregnancy on peak flow values in women with asthma

The impact of pregnancy on peak flow values in women with asthma

By Claudia Anderson Beckmann

Abstract

Asthma is the most common respiratory complication of pregnancy and affects approximately four per cent of all pregnant women. The purpose of this study was to establish normative data regarding how peak flow values change during gestation in pregnant women with asthma. Eighteen pregnant women with asthma were recruited and completed daily logs throughout their pregnancies. The findings suggest there is a difference in peak flow values in different trimesters. Specifically peak flow values were highest in the second trimester with significant differences between the second and third trimesters. While the sample size is small it does provide longitudinal data that suggest changes in asthma as the pregnancy progresses. This study represents a logical next step in identifying the impact of pregnancy on asthma.

The incidence of asthma has increased from 6.7 million in 1980 to 17.3 million in 1998 (Centers for Disease Control, 2004). Additionally, a large group of children with asthma are now reaching their childbearing years. Asthma in pregnancy has increased risks of adverse outcomes, including preterm labour and delivery, pregnancy induced hypertension, placenta praevia, caesarean delivery, low-birth-weight infants, neonatal sepsis, and perinatal mortality (Schatz, 1999). In addition, asthma may interfere with daily functioning (Beckmann, 2002). Although peak flows are commonly used to substantiate and manage symptoms, changes in peak flows for pregnant women are not known. Using peak flow values from non-pregnant asthmatics without knowing if the values are similar in the non-pregnant state as the pregnant state presents a serious flaw to potential research studies. Furthermore, using peak flow values which have been obtained from pregnant women who do not have asthma also presents a flaw.

Study aims

A gap exists in the literature regarding prospective and longitudinal changes in the course of asthma during pregnancy. The purpose of this study is to describe the effect of pregnancy on peak flow values in women with asthma. The study sought to answer the following research questions for pregnant women with asthma.

- How do daily peak flow measurements change during the course of pregnancy in women with asthma?
- How do asthma symptoms correlate with peak flow measurements in pregnant women with asthma?

Background and significance

Asthma is the most frequent respiratory disorder complicating pregnancy and may occur in up to four per cent of all pregnancies (Schatz and Zeiger, 1997; Venkataraman and Shanies, 1997) but these estimates may be conservative due to under reporting and lack of diagnosis (Tan and Thomson, 2000). Over the past decade the prevalence and mortality associated with asthma has increased and this increase has been more significant in women (Witlin, 1997). Despite research on the causes and treatment of asthma there has been relatively little attention to the growing number of pregnancies complicated by asthma (Schatz, 1999). Lack of control of asthma results in asthma exacerbations with cardinal symptoms of coughing and wheezing resulting in dyspnoea, hypoxia, and hypercapnia. Asthma may be under-treated during pregnancy and the resulting poor asthma control has been associated with adverse perinatal outcomes.

Peak flow assessments have been recommended for continued monitoring of the status of asthma when asthma is considered stabilised (Expert Panel Report 2, 1997). Spirometry is recommended when the initial diagnosis of asthma is made and on a yearly basis to validate the accuracy of peak flow assessments.

Peak flow measurements have been used as an objective indicator of signs or symptoms of asthma. Peak flow values were studied across three trimesters of pregnancy and one measurement postpartum in 57 women without asthma or recurrent respiratory disease (Brancazio and Laifer, 1997). No significant differences in peak flow readings were obtained across the time periods. Mean peak flow values were 434, 452, 444, and 450 during the first, second, third, and postpartum periods respectively.

The present study fills a vital gap in the literature regarding peak flow values during pregnancy. First, normative values will be established with pregnant women with asthma. Second, changes in peak flow values by week, rather than trimester, will be identified. A significant gap in the literature relates to the lack of longitudinal studies across pregnancy in women with asthma. Such information is a necessary next step in developing intervention studies aimed at improving outcomes of pregnancy in women with asthma.

During pregnancy, asthma control may improve, stay the same, or become worse. Research on the timing of asthma exacerbations during pregnancy is limited and confusing. Stenius-Aarniala et al (1988) found a greater incidence of

Claudia Anderson Beckmann, Associate Professor, College of Nursing, Rutgers University, Newark, USA

asthma attacks between the 17th and 24th week of pregnancy, perhaps because of women stopping their asthma medications. However, Schatz and Zeiger (1997) found more asthma attacks between 24 and 36 weeks gestation and a decrease in symptoms during the last four weeks of pregnancy. Neither of these investigators described which asthma symptoms were measured or how exacerbations were defined. Both investigators concluded that asthma symptoms were decreased early in pregnancy and during the last four weeks but were worse during the middle part of pregnancy.

Pregnancy may interact with asthma to cause improvement in symptoms at some gestational ages but cause worsening of symptoms at different points. Prior studies to date have focused on perinatal morbidity and mortality related to asthma. Data are lacking regarding the changes in peak flow values throughout pregnancy in women with asthma. Knowing when or if peak flows improve or worsen will provide information about when interventions should be instituted for pregnant women with asthma.

Table 1. Mean Peak Flow Values by Trimester of Pregnancy

	First Trimester (M/SD)	Second Trimester (M/SD)	Third Trimester (M/SD)
Peak Flow Value	375.72 (41.15)	381.39 (45.88)	363.28 (50.53)

Note: Results of repeated measures analysis of variance: F=6.527; df-2, 16; p<.008

Table 2. Paired Samples Test of Peak Flow Values by Trimester of Gestation

	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. I2-tailed)
First Trimester-Second Trimester	-5.6667	20.64	4.86	-1.165	17	.260
First Trimester-Third Trimester	12.4444	27.78	6.55	1.900	17	.074
Second Trimester-Third Trimester	18.1111	21.07	4.97	3.65	17	.002

Study design and methods

The purpose of this descriptive longitudinal study was to investigate how peak flow values change as pregnancy progresses. Subjects were enrolled into the study during the first trimester of pregnancy. Participants kept a daily log recording peak flow measurements from the time of recruitment into the study until delivery.

Sample

English-speaking pregnant women (N=18) whose asthma (not exercise-induced only) was diagnosed by a health care provider prior to pregnancy, were recruited from local prenatal clinics and from private offices. Once women with asthma who were in the first trimester of their pregnancies were identified, the investigator or a research assistant met the potential subject to explain the study and allow the potential subject to ask questions.

Of the 18 women who participated in the study, 14 were caucasian, 2 were Hispanic, and 1 each were African American and Indian. The mean age of the study participants was 28 years (range 19-39 years) and the mean age of asthma diagnosis was 13.5 years. The mean gestational age at the initiation of prenatal care was 6.7 weeks and the mean gestational age at enrolment into the study was 9.1 weeks. The number of pregnancies was five (N=1), four (N=3), three (N=1), two (N=7), and first pregnancy (N=6). The number of prior live births was four (N=2), three (N=3), two (N=1), one (N=7), and zero (N=7). The mean gestational age at delivery was 39.8 weeks (range 37-40 weeks).

Asthma history was elicited upon enrolment into the study. As far as the management of asthma is concerned, two women were cared for by a pulmonologist, one by an internist, four by an allergy/immunology specialist, and eleven by a family physician. Eight of the participants had been hospitalized for asthma and one had required intubation. Two of the participants rated their asthma as severe, five said their asthma was moderate, and eleven said they had mild asthma. Five of the women stated their asthma was worse since becoming pregnant, nine said it was the same, and four said it was better. Seven women said they needed more medication after becoming pregnant, eight said they were taking about the same amount of medication, and three said they were taking less medication than when they were not pregnant.

Procedures

The study was explained by the investigator or research assistant, questions were answered, written informed consent was obtained and the study procedures were explained. Women were instructed on the use of peak flow measurements. Prior to using any bronchodilating agents women performed three peak flow assessments and recorded the best of the three measurements on the daily log. Women were also asked to record asthma symptoms, exacerbations, medications, and smoking on the daily log. These events may be correlated with changes in peak flow values. Women mailed the daily log to the investigator every two weeks and a new log was mailed to participants.

Instruction for the use of the peak flow were consistent with the Expert Panel Report 2 Guidelines (1997). Five steps were incorporated into the education regarding the use of the peak flow meter (page 29). Participants then wrote the best of three blows in their diary.

In order to encourage participation study subjects were contacted by telephone to remind them to complete and record the assessments and mail them to the investigator.

Demographic data were collected upon enrolment into the sample. Data included information related to asthma (age at initial diagnosis, previous hospitalisations, intubations, exposure to smoke, asthma medications, perceived severity of asthma) as well as pregnancy-related data (number of pregnancies, gestational age upon enrollment, due date).

Data analysis

Frequency data were calculated from the daily log, and mean scores derived for each data point (week of gestation). Demographic characteristics of the sample are reported using descriptive statistics. Inferential statistics were used to denote differences between values.

Results

How do daily peak flow measurements change during the course of pregnancy in women with asthma?

In order to determine if differences in peak flow values existed between the three trimesters, an analysis of variance with repeated variance was performed on the mean peak flow value for each of the three trimesters. The mean peak flow for the first trimester was 378, for the second trimester 381, and for the third trimester 362. Table 1 shows the results of the analysis of variance and a significant difference between trimesters was found. In order to better understand where differences in peak flow values existed, paired t-tests were done for each of the trimesters. Results of this analysis are shown in Table 2 and show that peak flow values differed significantly between the second and the third trimesters.

How do asthma symptoms correlate with peak flow measurements in pregnant women with asthma?

Data regarding the most common asthma symptoms were collected in the daily log. The presence of symptoms was correlated with peak flow values for each week of gestation. Significant correlations are listed in Table 3. Interestingly, the majority of symptoms significantly correlated with peak flows occurred during the second trimester. The negative correlations indicate that as the peak flow values went down, reported symptoms went up.

Similarly, women were asked to rate how their asthma curtailed their activity each day. Curtailment of activities included not exercising, not being able to go outside, having to miss work, school or an activity because of the asthma and were self-reported by the respondents. Pearson Product Moment Correlation coefficients were calculated between peak flow values and how women perceived their asthma influencing their activity. These results are shown in Table 4 and indicate that as peak flow values fell, activities were also curtailed.

Study implications

This study included women who sought prenatal care early and were in good health with the exception of their diagnosis of asthma. Even though they were healthy, the women exhibited a number of asthma symptoms and exacerbations.

Unlike the study of Brancazio, Laifer, and Schwartz (1997) peak flow values did differ significantly by trimester in the

Table 3. Significant correlations between reported asthma symptoms and obtained peak flow values by week gestation

	Asthma symptoms						
Week gestation	Chest tightening	Difficulty breathing	Gastrointestinal reflux disease (GERD)	Fever	Difficulty sleeping	Coughing	Wheezing
11			-0.490 0.039 18				
15	-0.574 0.013 18	-0.776 0.000 18		-0.470 0.049 18		-0.776 0.000 18	-0.757 0.000 18
16	-0.574 0.013 18	-0.602 0.008 18			-0.565 0.015 18		
17				-0.543 0.020 18			-0.702 0.001 18
18		-0.682 0.002 18					
19				-0.484 0.042 18			
20				-0.509 0.031 18			
21		-0.539 0.021 18				-0.506 0.032 18	
22		-0.590 0.010 18			-0.481 0.043 18		
23		-0.595 0.009 18				-0.499 0.035 18	-0.539 0.021 18
24						-0.478 0.045 18	

*Correlation is significant at the 0.05 level or greater (2-tailed); First line = Pearson Correlation, second line = level of significance, third line= N

present study. This study found differences in peak flow values between trimester two and trimester three. Perhaps the major hormones of pregnancy (primarily progesterone and oestrogen) either improve or exacerbate the course of asthma.

Significant correlations

The interesting finding of this study has to do with the significant correlations with peak flow values and asthma symptoms. In recording the most common asthma symptoms, significant correlation coefficients were obtained between asthma symptoms and the second trimester. Stenius-Aarniala, Hedman and Teramo (1988) and Schatz and Zeiger (1997) all suggest an increase in asthma exacerbations during the second trimester yet the present study found that the highest peak flow values occurred in the second trimester

Table 4. Significant correlations between self-reported curtailment of activity and obtained peak flow values by week gestation

Week gestation	Curtailment of activity
10	-0.656 0.003 18
11	-0.698 0.001 18
15	-0.776 0.000 18
16	-0.773 0.000 18
17	-0.702 0.001 18
18	-0.704 0.001 18
19	-0.469 0.049 18
21	-0.481 0.043 18
22	-0.570 0.014 18
23	-0.539 0.021 18
24	-0.535 0.022 18
25	-0.513 0.030 18
28	-0.467 0.050 18
32	-0.523 0.026 18
33	-0.496 0.036 18

*Correlation is significant at the 0.05 level or greater (2-tailed)
First line = Pearson Correlation, second line = level of significance, third line = N

Key Points

- Asthma is the most common complication of pregnancy and affects approximately four per cent of all pregnant women.
- Asthma in pregnancy has increased risks of adverse outcomes, including preterm labour and delivery, pregnancy induced hypertension, placenta praevia, caesarean delivery, low-birth-weight infants, neonatal sepsis, and perinatal mortality.
- Peak flow values differ significantly between the second and third trimester.
- Women attributed curtailment of their activiities during pregnancy to their asthma status.
- This study fills a gap in the current literature and provides a prospective, longitudinal assessment of how pregnancy affects asthma peak flow values.

Women did seem to attribute having to curtail activities to their asthma status. In an earlier study, Beckmann (2002) surveyed women during pregnancy and found that asthma symptoms forced respondents to curtail their activities. While not all of the significant correlation coefficients occurred during the second trimester the major of significance did occur in the second trimester. Again, this finding warrants further investigation.

This study fills a gap in the current literature. This study provides a prospective, longitudinal assessment of how pregnancy affects asthma peak flow values. Prior studies have provided peak flow information by trimester of pregnancy in women without asthma or respiratory diseases. Unlike prior studies, this study demonstrated a difference in peak flow values between trimesters in pregnant women with asthma.

The present study certainly raises questions for further study. The study suggests that pregnancy does have an effect on asthma and further investigation is suggested. The next series of investigations will include measurement of hormonal levels during pregnancy and their influence on pregnancy status as well as the influence of environmental triggers on the status of asthma. **BJM**

Beckmann CAA (2002) Descriptive study of women's perceptions of their asthma during pregnancy. MCN Am J Matern Child Nurs **27**: 98-102
Brancazio LR, Laifer SA, Schwartz T (1997) Peak expiratory flow rate in normal pregnancy Obstet Gynecol **89**: 383–6
Centers for Disease Control (2004) Asthma Prevalence and Control Characteristics by Race/Ethnicity — United States 2002. MMWR Morb Mortal Wkly Rep **53**(7):145-8
NIH (1997) Expert Panel Report 2. Guidelines for the Diagnosis and Management of Asthma National Asthma Education Prevention Program. National Institutes of Health, **97**: 4051
Schatz M (1999) Interrelationships between asthma and pregnancy: A literature review. J Allergy Clin Immunol **103**: S330-6
Schatz M, Zeiger RS (1997) Asthma and allergy in pregnancy. Clin Perinatol **24**(2): 407–32
Stenius-Aarniala B, Piirila P, Teramo K (1988) Asthma and pregnancy: A prospective study of 198 pregnancies. Thorax **43**: 12-18
Tan KS, Thomson NC (2000) Asthma in pregnancy. Am J Med 109: 727–33
Venkataraman MT, Shanies HM (1997) Pregnancy and asthma. J Asthma **34**(4): 265-71
Witlin A (1997) Asthma in pregnancy. Semin Perinatol **21**: 284-97