

Peak Flow Values by Gestation in Women with Asthma

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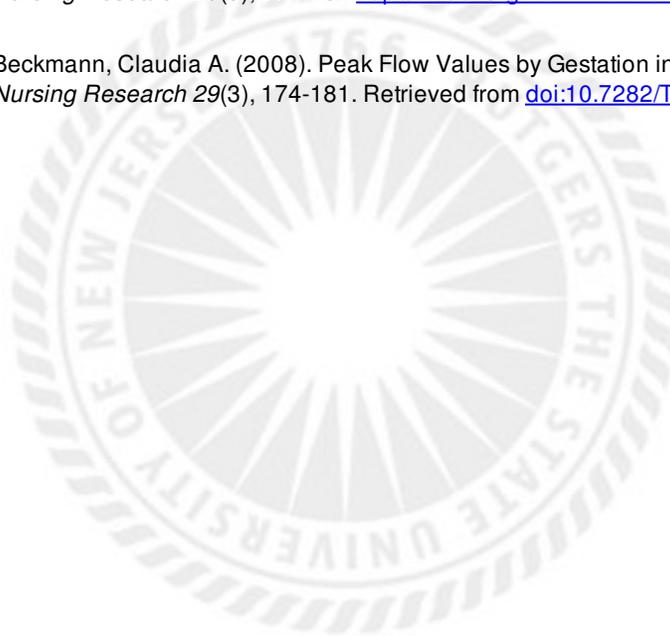
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Peak Flow Values by Gestation in Women with Asthma

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Abstract

Asthma is one of the most common medical complications of pregnancy. Control of asthma is associated with improved perinatal outcomes compared with pregnancies of women whose asthma is not controlled. Peak flow measures have been recommended to determine the status of asthma yet norms for peak flow values in women with asthma are missing from the literature. The purpose of this prospective, longitudinal study was to determine average peak flow values in pregnant women with asthma. Forty three women were recruited into the study prior to the twentieth week of pregnancy. Demographic data including age, ethnic background, and number of pregnancies were collected. Type and severity of asthma, medications used for asthma, and past hospitalizations for asthma was recorded. Peak flow values increased across the three trimesters. Significant differences were found in peak flow values between the first and third trimesters (>0.001) and the second and third trimesters (>0.007). Findings from the present study contradict those of studies on pregnant women without asthma. Since hormonal levels change during pregnancy and hormones are thought to influence the status of asthma, the interaction of hormonal changes of pregnancy and asthma warrant further study.

Introduction

Asthma is one of the most common medical complications of pregnancy and affects between 3.7 and 8.4 percent of all women (Kwon et al 2004). Literature regarding the course of asthma during pregnancy is inconclusive and conflicting. During pregnancy asthma control may improve, stay the same, or worsen. Maternal asthma has been associated with increased perinatal morbidity and mortality including pregnancy induced hypertension, placental abruption, preterm labor and birth, increased cesarean rates, and low birth weight infants (Dombrowski, 2006, Getahun, Ananth, Peltier, Smulian, Vintzileos, 2006). Improved perinatal outcomes exist in women whose asthma is more well controlled.

Stenius-Aarniala, Hedman & Teramo (1996) found a greater incidence of asthma exacerbations between the 17th and 24th weeks of pregnancy and speculated this might be due to women discontinuing their asthma medications. These authors prospectively studied 504 pregnant women with asthma throughout their pregnancies. Of these women, 47 had an asthma exacerbation while 457 did not have an exacerbation. Of these women, 177 were not initially prescribed inhaled corticosteroids. Seventeen percent of women who were not initially on inhaled corticosteroids had acute asthma attacks compared to 4% of the 257 women who were on inhaled corticosteroids from the beginning. Schatz & Zeiger (1997) found more asthma attacks occurring between the 24th and the 36th weeks of gestation and a decrease in asthma 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

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decreased early in pregnancy and during the last four weeks but were worse during the middle part of pregnancy.

Changes in respiratory function during pregnancy may influence asthma in either a positive or a negative way. Improvement in asthma may be the result of increased circulating cortisol levels which augment cyclic adenosine monophosphate (cAMP) functioning and reduce inflammation and irritation through steroid action. Elevated cAMP levels may cause bronchodilatation and progesterone decreases bronchomotor tone which may decrease airway resistance. Thus, improvement in asthma during pregnancy may be due to decreased airway resistance, increased plasma histamine, and decreased bronchial smooth muscle tone (Blackburn, 2003). On the other hand, asthma may worsen during pregnancy due to increased levels of progesterone and mineral steroids which compete for glucocorticoid receptors, increased allergens or respiratory infections, or increased PGF_{2a} (Blackburn, 2003). Thus the course of asthma during pregnancy is dependent on the interaction of the above factors.

Monitoring of pulmonary status is an important determinant in identifying changes in asthma during pregnancy (National Asthma Education and Prevention Program, 2004). Spirometry is recommended at the initial prenatal visit but peak expiratory flow measurement can be used for follow up visits.

Statement of the Problem

Peak flow values have been calculated during pregnancy and have not found to vary significantly by trimester yet subjects for this study did not have asthma or other respiratory diseases (Brancaio, Laifer, & Schwartz, 1997). The purpose of the present study was to determine if peak flow values differed by trimester in women with asthma

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and to provide normative data regarding peak flow values in pregnant women with asthma. The hypothesis being tested was:

There is no difference in peak flow values by trimester in pregnant women with asthma.

Study Design

A prospective longitudinal descriptive study was conducted to determine peak flow values in pregnant women with asthma, by trimester, throughout the pregnancy

Sample

After approval from the respective Institutional Review Boards pregnant women with asthma were recruited for participation into the study from a prenatal care clinic at a Northeastern university clinic. Attempts were made to enroll women into the study during the first trimester; however, due to late enrollment in prenatal care, fifteen women were enrolled in the study in the second trimester. Of the women enrolled in the second trimester, all were enrolled by the twentieth week of pregnancy. Of the fifty eligible participants seven (14%) declined to participate. The women who declined participation did so because of the commitment to taking and recording daily peak flows. Forty three women participated in the study.

Of the 43 participants, twenty (46.5%) had been hospitalized for asthma and five (11.6) had been intubated for an asthma exacerbation. All of the hospitalizations occurred prior to pregnancy and the initiation of the study. Women were excluded if they had severe asthma or had asthma induced by exercise only. Women with severe asthma were excluded as their peak flows may have been decreased and might have influenced the study results. Similarly, women with exercise induced asthma were excluded because

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the study sought to determine peak flow values in women with persistent asthma not just asthma induced by exercise. The diagnosis of asthma and the severity of asthma was based upon a documented diagnosis from a prior health care provider. Categories of asthma were in accordance with the National Asthma Education and Prevention Program (2004) guidelines. Eleven (25.6%) of the subjects smoked. The majority of women (81.4%) used beta₂agonists as a primary medication, five women (11.6%) took leukotriene inhibitors, and three women (7%) were on no medication for their asthma.

None of the participants were hospitalized for asthma during pregnancy although several (8) women reported asthma exacerbations which were attributed to seasonal allergies, upper respiratory infections, or exposure to allergens (paint). Women reported increasing use of an inhaler, going on antibiotics for an infection, or avoiding the allergen when symptoms increased. Women reported asthma symptoms and increased use of medication at the next prenatal visit.

Peak flows for women were in the green zone (indicating asthma control) for the majority of data points. Three women experienced peak flow values in the orange zone (indicating caution) when asthma exacerbations occurred. It was during these ranges that women reported increase use of inhalers. None of the women had peak flow values in the red zone during the study period. Women were encouraged to report peak flow values in the orange and red zones should such findings occur and were encouraged to contact the clinic with persistent symptoms. None of the women experienced a long-term change in asthma medications during pregnancy although they did report increased inhalers when asthma symptoms increased.

Methods

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The study was explained to prospective pregnant with asthma and, if interested in participating, women signed written informed consent. Since peak flow values have been shown to vary by maternal position (Harirah et al, 2005) peak flows were taken with women standing. Women were instructed to perform peak flow measures according to guidelines from the National Asthma Education Prevention Program (2004). Women were instructed to take a deep breath in and forcibly exhale into the peak flow meter. Women performed three peak flow measurements and the best of the three values was recorded. Peak flows were taken and recorded at every prenatal visit. Each study participant was given her own peak flow meter and she was encouraged to do peak flow measurements each morning prior to using any asthma medication. Women were encouraged to call their health care provider if the peak flow values fell to a level previously determined to be indicative of a change in asthma status. Women were asked to bring their peak flow meters to clinic when they came in for their prenatal visits. In the event that a woman forgot her peak flow meter on a prenatal visit, the same type of peak flow meter that was given to study participants was available for use.

Data Analysis

Descriptive statistics were used to analyze the demographic characteristics of the sample. Peak flow values were taken and recorded on a daily basis and average peak flow values by week of gestation were made. Peak flow values were summarized and divided by the number of days in the week that peak flow values were obtained. Since subjects enrolled in the study at various weeks gestation, the mean peak flow by trimester was summarized by taking the mean peak flow by week and dividing it by the weeks gestation. Mean peak flow values were determined for each trimester. The first trimester

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was considered weeks 1-12, the second trimester weeks 13-28, and the third trimester from weeks 29 until delivery. In order to test the hypothesis *there is no difference in peak flow values by trimester in pregnant women with asthma* an analysis of variance with repeated measures technique was performed to compare mean peak flow values by trimester of pregnancy.

Results

Mean age of participants was 28 years with a range of 17 to 41 years. Seven (16.3%) women were Hispanic, 23 (53.5%) were Caucasian, 12 (27.9%) were African American and one was Indian (2.3%). Number of pregnancies ranged from one to seven with a mean number of 2.58.

Mean peak flow by trimester were: 358.82 first trimester (range 294-450), 373.86 second trimester (range 318-560), and 424.79 third trimester (range 313-600). These results are shown in Table One. In order to determine if the peak flow values differed by trimester a multivariate analysis was performed using SPSS for windows version 15. The Wilks' Lambda obtained was .479. These results are found in Table Two.

In order to determine where significant differences existed between trimester of pregnancy, t-tests were performed to determine which of the peak flow values were significantly different. These results are shown in Table Three. Significant differences were found between the first and the third trimesters and the second and third trimesters.

Discussion and Clinical Implications

Findings from the current study contradict the findings of Brancazio, Leifer, & Schwarz (1997) who found that peak flow values did not change significantly during pregnancy (434 first trimester, 444 second trimester, and 450 third trimester). Findings

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from the present study also contradicted findings from Harirah et al (2005) who found that peak flow values declined gradually but not significantly during pregnancy and postpartum. Harirah et al studied peak flow values in the sitting, standing and supine position every four weeks during pregnancy and through six weeks postpartum. Both of the previous studies were conducted with healthy women without respiratory disease. In the present study peak flow values were measured daily from the enrollment in the study until delivery. Women in the present study had peak flows lower at all trimesters than women in the Bancazio, Leifer & Schwarz (1997) study. Further study is warranted to prospectively compare peak flow values in women with and without asthma during pregnancy.

Asthma is a respiratory disease consisting of a reactive upper respiratory system and is often treated with beta₂-agonists that act by relaxing airway smooth muscle by stimulating beta₂-receptors thereby increasing cyclic AMP and producing opposition to the bronchoconstriction that often accompanies asthma exacerbations. The present study found that peak flow values increased throughout pregnancy. Progesterone which causes smooth muscle relaxation and increases until about 36 weeks gestation may stimulate cyclic AMP levels thereby causing bronchodilation. This may cause an improvement in the asthma and may result in increasing peak flow values during pregnancy.

The course of asthma may change during pregnancy and a woman's response to asthma is reflected by increased symptoms and changes in respiratory status which can be detected using peak flow measurements (National Asthma Education Program, 2004). Maintaining control of the status of asthma is associated with improved perinatal outcomes. Decreases in peak flow values may indicate a worsening of asthma. The

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present study provides baseline data regarding how peak flow values change during pregnancy in women with asthma. Results of the present study can be considered by health care professionals caring for pregnant women with asthma. During the normal course of pregnancy peak flow values seem to improve in women with asthma.

Understanding a normative peak flow value will facilitate knowing when the condition is deteriorating. Absolute values are less important than comparing changes in peak flow measurements. Nursing plays a major part in controlling asthma. This role includes helping the woman identify and avoid asthma triggers, monitoring the status of asthma through peak flow measurements, and implementing a medication action plan as indicated. The study suggests the benefit of serial peak flow assessments in pregnancy in women with asthma.

Contrary to studies which have shown that peak flow values do not change during pregnancy, the present study suggests that peak flow values do differ during the course of pregnancy in women with asthma. This study suggests that peak flow values increase by trimester. While the first and third trimesters and the second and third trimesters differed significantly, these differences are not thought to be clinically significant as all of the results obtained were within the 80% (orange or green zone) peak flow value ranges. Since the research is conflicting and all of the samples sizes utilized thus far have been relatively small, further research is recommended. While the present study excluded both women with severe asthma and exercise induced asthma only, further control is recommended by having larger sample sizes and being able to analyze data based upon the severity of asthma.

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Asthma is a common complication in pregnancy. Monitoring of the status of asthma is instrumental in preventing adverse outcomes and can be expeditiously done using peak flow measures. Further research regarding the interaction of hormonal values, gestational age, and asthma status will provide further evidence upon which to base nursing practice.

The results of the present study contradict previous studies documenting peak flow values in pregnancy. The present study investigated peak flow values in pregnant women with asthma and showed that peak flow values tend to increase by trimester. Peak flow measures are an indirect means of determining the status of asthma and it may be inferred that increased peak flow values also indicate improved asthma control. Nurses play an important role in education and monitoring the status of asthma. The present study indicates that at least peak flows improve as gestation increases and perhaps this indicates a protective effect of hormones such as progesterone. Further research is indicated.

Table One

Mean Peak Flow Values by Trimester of Pregnancy

	Mean	Std. Deviation	N
First Trimester	358.82	50.727	28*
Second Trimester	373.86	55.69	43
Third Trimester	414.79	52.049	43

*The remainder of the sample did not enroll in the study until early in the second trimester

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Table Two
Multivariate Test Comparing Mean Peak Flow Values by Trimester of
Pregnancy

Effect	Value	F	df	Error df	Sig.	Partial Eta Square
Wilks' Lambda	.479	14.168	2	26.00	.000	.521

Table Three**t-Tests comparing mean peak flow values by trimester of pregnancy**

Trimester	t	Pooled variance	df	Sig
First and second	-0.92054	2756.59	69	0.360496
First and third	-3.36325	3091.533	69	0.00126
Second and third	-2.78223	3149.575	84	0.006665

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