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EFFECT OF ADVANCED UNCOMPLICATED PREGNANCY ON PULMONARY FUNCTION PARAMETERS OF NORTH INDIAN SUBJECTS

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Abstract : The study was conducted on 100 pregnant women in third trimester of uncomplicated pregnancy (Test group) and 100 age-matched non-pregnant women (Control group) in the age group of 25 to 35 years. Pulmonary function test parameters FVC, FEV_1, PEFR and $FEF_{25-75\%}$ recorded using Medspiror. The FEV_1/FVC ratio was calculated. All parameters except FEV_1/ FVC ratio were found to decline in the Test group as compared to the Control group. The decrease in FEV_1 with pregnancy was not of such amplitude as decrease in FVC, and hence FEV_1/FVC ratio was seen to increase. This study validates the physiological changes in pulmonary function brought by pregnancy and highlights the need to compile expected and accepted alterations in predicted values of PFT in comparison with the non gravid states for safer outcome of the pregnancy.

Key words : pulmonary function tests pregnancy third trimester

INTRODUCTION

The events in pregnancy elicit one of the best examples of selective anatomical, physiological and biochemical adaptations that occur during pregnancy and profound changes in respiratory physiology are a part of the same process (1). The changes in respiratory physiology (2) are due to increasing size of the fetus with advancing gestation which constitutes a mechanical impediment to normal process of ventilation (3).

The physiological adaptations of the pregnant woman involve the circulatory, respiratory, digestive, renal, endocrine and metabolic systems. Their precise knowledge allows the clinician to verify the extent of the adaptation in pregnant women and helps to avoid unnecessary treatment of physiological changes misinterpreted as pathological changes in reference to pre-pregnancy standards(4).

The knowledge of the expected or desired changes in pulmonary parameters is fundamental to understanding of how the disease states affect pregnancy and vice versa (5) Also, information regarding status of pulmonary function is essential for assessment of fitness for anaesthesia (6). Although there are reports of changes in pulmonary function tests during pregnancy in the western population, but not much work has been documented on similar studies in Indian subjects, the literature which is a little less vocal on the subject for studies done on North Indian subjects.

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This study was undertaken to evaluate the pulmonary functions of women in the third trimester of uncomplicated pregnancy and to compare them with those of normal non-pregnant women with a view to define the standards of normalcy in pregnancy and also to document expected changes in pulmonary parameters in North Indian women in the last trimester of normal gestation.

MATERIALS AND METHODS

This prospective study was conducted in the Department of Physiology in collaboration with Department of Obstetrics and Gynaecology, at Christian Medical College & Hospital, Ludhiana, Punjab, India over a period of one year after approval from institutional research and ethical committee.

The study included 100 North Indian pregnant women in their third trimester of uncomplicated pregnancy (Test) and 100 non-pregnant women (Control). The pregnant women were included from antenatal OPD. The age matched controls were volunteers from the relatives of pregnant women who were attending the OPD and from amongst the hospital staff and students. Test subjects were either primigravida or multigravida in the age group of 20-35 years. Those with known respiratory or cardiovascular diseases, anaemia, multiple pregnancy, hydramnios or those on chronic therapy for any other ailment were excluded from the study.

After taking informed written consent from each subject, a detailed history was recorded and complete clinical examination was done to rule out the exclusion criteria. The height as well as weight of the subject were noted as also the room temperature on the day of assessment of Pulmonary function tests (PFT). The equipment used for PFT was Medspiror.

Prior to performing the PFT, the procedure was thoroughly explained to each subject, the queries and apprehensions of the subjects were satisfied emphasizing the need to maintain an effective seal with lips around the mouth piece as also the use of nose clip during the procedure. Each subject was made to relax for minimum 5 minutes prior to performing the PFT procedure.

The following parameters were recorded in Test and Control subjects;

1. FVC: The maximum volume of air expired after a maximum inspiration.
2. FEV_1: Forced expiratory volume in first second) the fraction of vital capacity expired during the first second of a forced expiration.
3. $FEF_{25\%-75\%}$: Forced mid expiratory flow
4. PEFR: Peak expiratory flow rate
5. FEV_1/FVC ratio

Recording of PFTs

The relaxed subject, in a standing position, was prepared to grip the sterile mouth piece as demonstrated to her prior to the recording. When the subject was confident and familiar with the procedure, she was asked first to perform maximal inspiration after a deep expiration. The subject was then instructed to expire with maximal effort (maximal expiration). The mouth piece was then removed and the actual, predicted and percentage of predicted values were printed for analysis.

Each subject (Test or Control), was asked to repeat the maximum forced expiratory effort three times, each time with adequate rest in between, and the best reading of the three was considered for analysis.

Statistical analysis of data

Data was compiled using Microsoft Office 2003 Excel software. Statistical analysis was done using one-way ANOVA and Student's 't' test. Coefficient of correlation was performed by Pearson correlation analysis.

RESULTS

Table I shows baseline data of study and control groups. There was no statistically significant difference of mean age between the two groups. In the study group, the weight of subjects was higher as compared to those in the control group and the heights of both the groups were comparable. Study group showed higher BMI than the control group. Heart rate, systolic blood pressure and diastolic blood pressure were comparable in both the groups. Mean hemoglobin in the Test group was less (11.01 ± 0.81 g/dL) as compared to (11.74 ± 0.58 g/dL) among the controls, which was found to be statistically significant ($p<0.01$).

TABLE I : Baseline data of study and control subjects.

Parameters	*Test*	*Controls*
Age (yrs)	25.27 ± 3.06	25.18 ± 3.99
Height (cm)	154.51 ± 5.15	159.45 ± 5.23
Weight (kg)	64.5 ± 10.35	58.06 ±11.91*
BMI (kg/m--^{2})	27.04 ± 4.11	22.68 ± 4.10*
Heart Rate (beats/min)	80.76 ± 3.72	81.84 ±2.44
Systolic Blood Pressure (mm Hg)	119.64 ± 7.25	117.5 ± 6.58
Diastolic Blood Pressure (mm Hg)	76.40 ± 5.25	72.5 ± 4.39
Haemoglobin (g/dl)	11.01 ± 0.81	11.74 ±0.58

Data expressed are mean±SD. *$p<0.001$

All pulmonary function parameters, except FEV_1/FVC ratio, were found to be lower in the Test group as compared to the control group (Table II).

TABLE II : Pulmonary function parameters of study and control subjects.

Pulmonary function parameters	*Test*	*Controls*	*P value*
FVC (% predicted)	90.48 ± 9.55	95.69 ± 5.56	0.005
FEV_1 (% predicted)	91.84 ± 7.78	97.24 ± 3.53	0.004
FEV_1 / FVC ratio (actual)	83.46 ± 6.62	83.15 ± 6.28	0.485
PEFR (% predicted)	90.77 ± 9.38	96.01 ± 5.44	0.005
$FEF_{25-75\%}$ (% predicted)	87.89 ± 9.95	93.00 ±7.08	0.006

Data expressed are mean±SD.

DISCUSSION

In our study all the pulmonary function parameters except FEV_1/FVC ratio were found to be lower in the study group as compared to the control group. The decrease in FEV_1 with pregnancy is not of such amplitude as the decrease in FVC, so that the FEV_1/FVC ratio was seen to increase. Decrease in FVC in our study may be due to a relative decrease in the negativity of the intrapleural pressure brought about by an upward displacement of the diaphragm by the enlarging uterus (7).

Decrease in FEV_1, $FEF_{25-75\%}$ and PEFR may be due to a decline in alveolar Pco_2 (caused by hyperventilation) which acts as

bronchoconstrictor. Also the decrease in PEFR could be due to lesser force of contraction of main expiratory muscles like the anterior abdominal wall muscles and internal intercostals muscles (8). We found a similarity in our findings with those by Mokkapatti et al (6), Monga and kumari (9) Puranik et al (1995) (10) and Phatak and Kurhade (8), Harirah et al (11). Although none of our subjects had haemoglobin < 10gm/dL, we found that even the borderline change in Hb levels makes a difference to PFT values. It is obvious that pulmonary functions would definitely be compromised in women with severe chronic anaemia.

PEFR is more sensitive to muscular effort in respiration, and as anaemia produces muscle weakness it reflects in lowering the PEFR. It is possible that relative decrease in level of Hb in Test Vs Control groups might have caused decrease in PEFR in our study, which is in consistence with Puranik et al (10).

Thus our study validates the physiological changes, adaptations and decline in pulmonary function in pregnancy especially in the last trimester. The effect of the enlarged uterus displacing the diaphragm upwards is evident in the significantly reduced forced vital capacity among the pregnant subjects compared to the controls. The mechanical factors are not the only causative factors. Other factors such as hormonal influences also play a role, in altering and compromising the pulmonary flow parameters like FEV_1, PEFR and $FEF_{(25-75\%.)}$. We found that the FEV_1 / FVC ratio shows a definite increase due to less decrease in FEV_1 as compared to FVC.

The present study highlights observation that the respiratory parameters are significantly compromised due to gravid state in the last trimester of pregnancy in North Indian subjects. We feel, to establish norms on predicted and desired PFT values in various phases of pregnancy, extensive studies on larger population need to be done and the correction factors be introduced while evaluating PFT readings in such patients. In the absence of these norms of normal deviation from non gravid states, the computerized values obtained through routine spirometry may give inaccurate information of the respiratory status of the patient to the clinicians, obstetricians and anaesthetists managing complications in the last trimester of pregnancy.

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