



Variations of lung functions in pregnancy correlating with haematological changes

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ABSTRACT

Anemia is common in India as is present in the most of the developing countries. But anemia can also be present in non pregnant women as well as in men particularly in under nourished conditions the commonest types being deficiency anemia's like iron deficiency and B12 deficiency.

Anemia of pregnancy <Hb % 6-8 gm and reductions in overall muscle strength are some of the reasons for variations of lung functions in pregnancy. Anemia due to hemodilution is considered to be important factor for hematological variations in pregnancy.

Fifty primi pregnant women in three trimesters and fifty non pregnant women as control group. Pulmonary function tests and haematological tests were conducted in both groups to study and evaluate the influence of pregnancy on pulmonary function and haematological status.

Pregnancy induced changes in the thorax produce a progressive decrease in functional residual capacity to an extent of 10 to 20%.

The major changes due to the decrease of functional residual capacity is the decrease in the expiratory reserve volume. These alterations in lung volumes are measurable at 16 to 24 weeks of gestation and progresses until term.

RBC count, Hemoglobin estimation and PCV decrease in pregnancy and these changes are due to hemodilution. There is slight decrease in platelet count.

KEYWORDS : Lung function tests ,pregnancy, haematological tests .

Introduction

Rapid advances in technology and biochemistry since the beginning of this century have enabled a better understanding of the relationship between ventilation, perfusion and their regulation. For the past 50 years widespread use of X rays, the free availability of simpler tests with improved precision, have helped in the better assessment and management of patients with chronic pulmonary disorders.

Sven Gudmund Hinderakar et al [1995] described the prevalence and determinants of anemia among rural pregnant women living in Tanzania. Selected subjects were 3,836 pregnant women attending antenatal clinics between January 1995 and March 1996 in a cross sectional study. Identified Hb levels ranged from 4.5 to 18.1 gm /dl and mean was 12.1 g/dl. 23% had Hb < 11g / dl, 46% had lesser than 9g/dl and 0.5% had lesser than 7g/dl respectively. Higher risk of anemia was found at higher maternal age.

Debashis chekraborty conducted a study on 75 healthy pregnant women of 18-35 years who attended antenatal OPD, RIMS, IMPHAL during different trimesters of pregnancy to find out any variation in Haematological values. The platelet count was found to decrease during third trimester. The prothrombin time was markedly decreased during second and third trimesters. The study revealed the significant falling Haemoglobin and haematocrit value as pregnancy advances. Total Leucocyte count was also increased during the second and third trimesters. Increased neutrophil count and decreased lymphocyte count was found during later stages of pregnancy.

Materials and methods

The total number of subjects selected is fifty primi pregnant women in three trimesters and fifty nonpregnant women as control group. The pregnant women were all antenatal mothers attending antenatal O.P, Department of obstetrics and gynecology government general hospital, Kurnool. Pulmonary function tests and Haematological tests were conducted in both groups to study and evaluate the influence of pregnancy on pulmonary function and Haematological status.

The following criteria were set in order to select the subjects
All primigravidae age group range from 19 to 28 years
Height not less than 5 feet

weight not less than 40 kgs

Not suffering from respiratory tract infection at the time of test.

The maneuver with Spirovin was performed in sitting posture using pre calibrated computerized spirovin following standard procedure. The apparatus is computerized and self calibrating thus fulfils the criteria for standardized lung functions.

The following parameters of PFT were studied. Forced vital capacity, FEV, PEF and PIF. The following Haematological parameters were studied Hb, PCV, morphology of RBC, WBC count, DC, ESR and Platelet count. The data regarding age in years, weight in kgs, height in cms was entered via the input key board of computer to record the graphs.

Results

FVC [L]

	NON PREGNANT	I TRIMESTER	II TRIMESTER	III TRIMESTER
MEAN	1.987	1.945	1.986	1.833
S.D	0.303	0.181	0.33	0.382

FEV1 [L]

	NON PREGNANT	I TRIMESTER	II TRIMESTER	III TRIMESTER
MEAN	1.759	1.837	1.833	1.657
S.D	0.284	0.176	0.312	0.455

PEF [L/S]

	NON PREGNANT	I TRIMESTER	II TRIMESTER	III TRIMESTER
MEAN	3.855	4.616	4.722	4.217
S.D	0.934	0.572	0.481	0.709

Discussion

Pregnancy is the most important component of the women's reproductive period. The mother is not only expected to maintain her own nutritional status but also nourish the foetus. All the requirements of the factors including the respiratory necessities of the baby are to be met by the mother. To satisfy the respiratory needs a number of anatomical, biochemical, and hormonal changes both

pulmonary function and ventilation will take place. The anatomical changes consist of increased transverse diameter of the chest due to widened sub costal angle. This compensates for the level of the diaphragm, which is raised by the enlarging uterus. The diaphragm can be displaced up to 5cm. The loss of lung capacity can also be by an increase in the anterior posterior diameter of the thoracic cage, individuals increase in the chest circumference by 5 to 7cm. As has been mentioned the sub costal angle widens due to the enlarging uterus and relaxation of ligamental attachments mediated by the hormone - relaxin. Despite the significant anatomical changes diaphragmatic function remains normal. Pregnancy induced changes in the thorax produce a progressive decrease in functional residual capacity to an extent of 10 to 20%.

Residual volume may decrease slightly during pregnancy but the changes are not consistent. The major changes due to the decrease of functional residual capacity is the decrease in the expiratory reserve volume. These alterations in lung volumes are measurable at 16 to 24 weeks of gestation and progresses until term.

The increase in diameter of thoracic cage and preserved respiratory muscle function allow the vital capacity to remain unchanged, and total lung capacity decreases only minimally by term. Several measurements of the vital capacity can therefore be used to follow the patient with respiratory disease during pregnancy.

Measurements of airflow are also not significantly affected by pregnancy. Lung compliance don't appear to be influenced by pregnancy, but chest wall and total respiratory compliance are reduced in the third trimester because of chest wall changes and increased abdominal pressure. A significant increase in the respiratory minute Ventilation occurs beginning in the first trimester and reaching 10 to 20% above the base line, and term Ventilation increases by 50 to 70%. The hyperventilation is due to both increase in metabolic carbon-dioxide production (which increases drive due to the gestation period), as well as increase in the respiratory drive due to the elevated serum progesterone level. The effects of progesterone manifests soon after conception and the degree of hyperventilation correlates with the serum progesterone levels. Progesterone may act either as a direct respiratory stimulant or by changing the sensitivity of the respiratory center to carbon-dioxide. The augmented ventilation is the result of an increase in tidal volume to about 30 to 35%, due to increased rib cage volume displacement. "Respiration

So the present study illustrates that hemodilution occurs in pregnancy parallel to progress of pregnancy. In spite of apparent decrease in RBC count, hemoglobin estimation and PCV it can be considered that RCV is not affected. The respiratory parameters are not altered except in the increase of PIF. Thus the entire process of pregnancy is within the physiological limits in spite of an enormous increase in the metabolic turnover necessity for increased demands created by the fetus. The hyperventilation caused in pregnancy is not distressful to the mother, because it is due to the increased sensitivity of the respiratory centers to CO₂ due to increased secretion of progesterone.

An increased inspiratory capacity compensates for the decrease in functional residual capacity. The tidal volume increases in pregnancy. Thus hematological and respiratory adjustments in pregnancy are more physiological. The Vital capacity in the I trimester is 1.945±0.18 liters and the II trimester is 1.986± and in the III trimester is 1.833±0.38. These values as compared in the normal control group where FV is 1.987±0.30 liters. This test is no change in FVC because of the pregnancy. These findings correlate with available data. However FVC values comparable to the predicted values are uniformly slightly lower indicating the lower nutritional and social status capable even with the normal control group.

The FEV₁ in the control group is 1.758 ± 0.28 litres as compared with the I trimester in FEV₁ is 1.837±0.17 litres and in the II trimester is 1.833±0.31 L and in III trimester 1.657 ±0.45 L. Thus in FEV₁ there is no change in control group and in all the trimesters of pregnancy.

Peak expiratory flow rate : the obtained values of PEFR in control group is 3.855±0.93 L/S in the I trimester 4.616±0.57, II trimester 4.72±0.48 L/S, and in the III trimester 4.217±0.70 L/S. The increase in the I & II trimesters is statistically significant P ≤ 0.01 in the I trimester, P < 0.01 in the II trimester appeared to the normal. But a slight increase in the III trimester is statistically not significant is > 0.05 as compared to the normal group. This change is attributable to the effect of progesterone to relaxation of bronchiolar smooth muscle and the parts of the diaphragm. Inspiratory flow rate increases in the present study and the changes are uniform with available data.

Conclusion

- 1) With the advancement of pregnancy FVC decreases slightly from a mean of 1.987L in normal to 1.832L, which is not statistically significant.
- 2) A slight decrease in FEV₁ is noted in pregnancy from a normal values 1.78L to 1.675L, which is again not statically significant.
- 3) PEFR increases from 3.855L/sec to 4.5L/sec.
- 4) Inspiratory flow rate increase from 2.917L/sec to 3.173L/SEC. Which is statistically significant.
- 5) RBC count, Hemoglobin estimation and PCV decrease in pregnancy and these changes are due to hemodilution.
- 6) There is an increase in total WBC count and neutrophils count, but the changes are not considered in the present study, since the study depicted here towards respiratory parameters.
- 7) There is slight decrease in platelet count.

The study can be further extended to the other effects of hemoconcentration in some abnormal pregnancies and the effects of the same in amniotic fluid deficiency.

If BV can be recorded by tracer methods direct further studies of hemodilution is possible.

Summary

The pulmonary function test does not reveal any changes with advance pregnancy. A slight increase in PEFR and statistically significant rise in PIF can be attributed to be increase in the progesterone levels. Increase in progesterone is also responsible for hyperventilation of pregnancy.

Hemodilution occurs parallel with the advancement of pregnancy. Thus the present study concludes that pregnancy is a physiological phenomenon not toxing the mother.

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