

THE Journal of Obstetrics & Gynaecology of India

VOLUME XXII, No. 1

FEBRUARY 1972

PULMONARY FUNCTION IN PREGNANCY

by

MAHESH R. PANDYA,* M.D., D.G.O.

S. D. NISHITH,** M.D., M.S.

ROHIT V. BHATT,*** M.D., D.C.H.

It is surprising but true that the effect of pregnancy on respiratory function is not adequately studied. Considerable work is done on the effect of pregnancy on cardiovascular and renal systems. Pregnancy brings about increase in the work of most of the systems in the body, be it pituitary gland, thyroid, heart or kidney. It would be logical to expect increase in the respiratory function during pregnancy because the total oxygen requirement of the foetus has to be supplied by the mother. Certain anatomical and physiological changes during pregnancy may affect pulmonary function. The rising height of the uterus in the later months of pregnancy elevates the diaphragm and affects the abdominal component of respiration.

Recent studies have shown that trophoblasts travel through the uterine sinuses

and reach the alveoli of the maternal lungs. Histological studies have confirmed the presence of trophoblastic tissue in normal pregnancy. The high levels of chorionic gonadotrophin, oestrogen and progesterone during pregnancy may also affect pulmonary function. Progesterone is known to cause relaxation of smooth muscles of the body. Its effect on the smooth muscles of the bronchi and bronchioles needs study. The clinical observation that every second woman in the later months of pregnancy experiences some dyspnoea on normal exertion needs to be assessed and evaluated in the light of present knowledge. The term 'lightening' vividly conveys the feeling of comfort a woman experiences when the head enters the pelvic cavity thus lowering the diaphragm.

Few studies have been made on the effect of pregnancy on pulmonary function and the conclusions drawn are conflicting. Root (1923), Cohen (1938), Landt (1936), Widlund (1945) and others conclude that the vital capacity of the lungs

*Junior Lecturer.

**Professor of Physiology.

***Professor of Obst. & Gynec. Medical College, Baroda.

Received for publication on 22-4-71.

is increased during pregnancy, Rubin (1956), feels that there is a decrease, Cugell (1953) feels that vital capacity is unchanged. The normal values for different pulmonary functions in Indian women are not definitely established. The present study is undertaken to assess the pulmonary functions in normal pregnancy and the postpartum period.

Material and Methods

The study consists of 50 women from the antenatal clinic of the S. S. G. Hospital, Baroda and 23 non-pregnant women of the childbearing age served as controls. The controls were mainly lady doctors, nurses and lady medical students. The pregnant women from the study group were normal in all respects. They had haemoglobin values more than 11 G. per cent. These women had no obvious signs or symptoms related to the respiratory system. Those who presented in the earlier months of pregnancy were studied longitudinally in different trimesters and in the postpartum period.

The tidal volume, inspiratory reserve volume, expiratory reserve volume and the vital capacity were studied by the help of a spirometer (Fig. I). The procedure was well explained to the patient and then only was the test performed. At least four readings were taken for every test and the mean was taken for record purposes. The readings were converted into standard temperature and pressure of dry air (S.T.R.). Circumference of the chest was recorded at the level of the second rib and the eighth rib. The definitions of the above tests are as follows.

Tidal volume. It is the volume of air breathed in or out during quiet respiration. (normal 400-600 ml.).

Inspiratory reserve volume (I.R.V.). It is the maximum volume of air which can be inspired after completing the nor-

mal tidal inspiration i.e. inspired from the end inspiratory position (about 2000-3200 ml.).

Expiratory reserve volume (E.R.V.). It is the maximum volume of air which can be expired after a normal tidal expiration i.e. expired from the end expiratory position. (about 750-1000 ml.).

Vital capacity. It is the maximum volume of air which can be expelled from the lungs by forceful effort, following a maximum inspiration. (normal about 4.8 litres for the male and 3.2 litres for the female).

Analysis and Discussion

The mean height was 153.74 cms. with a range of 145 to 163 cms. (Table I). We

TABLE I
Vital Capacity in Relation to Height in the Third Trimester

Ht. in cms.	Vital capacity in fl.
141-145	1507.4
146-150	1544.3
151-155	1801.6
156-160	1910.8
161-165	2082.5

found increase in the vital capacity and other values with increase in the height. The mean age of the patients was 23.43 years with a range of 20 to 28 years. No definite correlation between age and pulmonary function could be found because the age range of the study group was very close. It is known that vital capacity is reduced with advancing age but this does not affect the childbearing age. We cannot opine on the effect of parity on pulmonary function because with one exception, all our patients were nulliparous.

The tidal volume of the controls and the patients in the postpartum period does not show significant difference.

TABLE II
Mean Values for the Pulmonary Functions

	Control (23) ml.	Second trimester (24) ml.	Third trimester (39)	Postpartum period (20)
1. Vital Capacity	1893.65	1610.3	1678	1781.25
2. Tidal volume	272.13	284.37	288.73	278.25
3. Inspiratory reserve volume	747.02	625.75	690.99	788.25
4. Expiratory reserve volume	796.78	686.62	730.32	747.42

There is a slight increase in the tidal volume during pregnancy which shows a fall to the normal levels in the postpartum period. These variations, however, are not statistically significant. Plass (1938), Widlund (1945), Cugell (1953) observed slight increase in the tidal volume throughout pregnancy.

Inspiratory reserve volume shows some increase as the pregnancy advances. However, the inspiratory reserve volume during pregnancy is lower than values in the control or the postpartum period. Cugell found five per cent increase in the inspiratory reserve volume in pregnancy as compared to the non-pregnant state.

There is no significant change in the expiratory reserve volume during pregnancy. Rubin (1956) and Cugell (1953) found a significant decrease in the expiratory reserve volume at term as compared to the postpartum period.

The vital capacity is lower during pregnancy than in the postpartum period or the non-pregnant state. Rubin came to a similar conclusion. Cugell found no significant change in the vital capacity during the pregnant state. The vital capacity in the third trimester is more than in the second trimester (Table II).

Average rise in the circumference of the chest wall from the second to the third trimester at second rib was 0.33

cms. and at eighth rib about 3.16 cms. This flaring of lower ribs in the third trimester increases the antero-posterior and transverse diameters of the chest wall.

Conclusions

1. There is increase in the vital capacity with increasing height.
2. Though the vital capacity increases with advancing pregnancy, it is lower than the vital capacity in the control group and in the postpartum period.
3. The changes in the inspiratory reserve volume, expiratory reserve volume and tidal volume are not significant.

References

1. Cohen, H. E. and Thomson, K. J.: *Surg. Gynec. & Obst.* 66: 591, 1938.
2. Cugell, D. W., Frank, N. R. and Gaensler, E. A.: *Am. Review Tuberculosis*, 67: 568, 1953.
3. Eastman, N. J. and Hellman, L.: *Williams Obstetrics*. Appleton Century Crofts. 13th, Edition.
4. Landt, C. K. and Benjamin, P. R.: *Am. Heart J.* 12: 592, 1936.
5. Plass, E. D. and Oberst, P. W.: *Am. J. Obst. & Gynec.* 35: 441, 1938.
6. Root, H. P. and Root, H. K.: *Arch. Int. Medicine*, 32: 411, 1923.
7. Rubin, Allan, Nancy and Russo: *Am. J. Obst. & Gynec.* 72: 963, 1956.
8. Widlund, G.: *Acta Obst. and Gynec. supplement*, I, 1945.

See Fig. on Art Paper I