PULMONARY FUNCTIONS DURING LAST TRIMESTER AND AFTER DELIVERY

by

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Introduction

Pregnancy brings about changes in all the systems of the mother to accommodate to the needs of the developing foetus. Cardiovascular, hematological, hormonal, metabolic and excretory changes of this state of physiology have been studied in detail. Changes in respiration, usually dominating in the last trimester, have been sparsely reported. We have attempted to study the changes in the lung volumes and vital capacity during pregnancy and immediately after the delivery.

Material and Methods

Seventy-five pregnant women, during their last trimester, who came for medical care to Old Civil Hospital, Surat, were selected for the present study (Group II). Out of these, twenty-four cases (Group III) were studied after delivery. Their ages varied from 18 to 47 years. The results of both groups are compared to a detailed study of a control group (Group I) (age, between 18 and 21 years), consisting of a large number of female medical students and nursing students (Skandhan and Mehta).

Subjects included in the study were not having any respiratory complaint. Their hemoglobin value (Sahli's Method) and respiratory rate were studied. All the 3 groups were classified according to their surface area.

Lung volumes (LV) and Vital capacity (VC) were measured with Hutchinson's spirometer. Subjects were made familiar with the working of the instrument before this study started. Tidal volume (TV), inspiratory reserve volume (IRV) and expiratory reserve volume (ERV) were estimated in the sitting posture, whereas VC was measured in three postures-standing, sitting and lying. All records were taken in post-absorptive state. Average of 3 readings of each test is reported. The readings were converted into standard temperature and pressure of dry air.

An attempt was made to find out if any change was present in LV and VC, parity wise. For this study, all the values were converted per square meter of surface area. Number of cases paritywise are as follows:

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Parity	One	Two	Three	Four	Five	Six
Total no. of Cases	18	13	21	5	11	7

Results

Hemoglobin values ranged from 8 to 12 gm per cent.

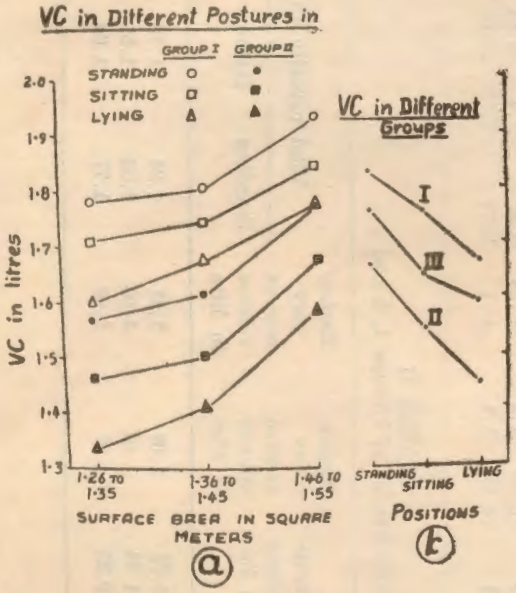

Fig. 1. (a)
Vital capacity in different postures in groups I and II, surface areawise and

(b)
Vital capacity in all the three groups in three different postures.

The results of groups I and II are given in Table I. Slight increase in TV (40 ml) and decrease in IRV (40 ml) and ERV (80 ml) were observed during pregnancy.

In all the 3 groups, maximum value of VC was observed during standing and minimum during lying position (Table II graph 1b). The change in the values of VC in different positions in groups I, II and III is given in Table III. The values of VC in all 3 postures of groups II and III are compared to the corresponding values of group I (Table IV). The comparative findings for groups I and II are presented graphically (graph 1a). Mean values of VC in 3 postures in all 3 groups is plotted in graph 1b.

TABLE III

Change in VC in Litre in Different Postures in Groups 1, 2 and 3

Groups		II	III
Standing minus sitting	+.08	+.11	+.13
Standing minus lying	+.16	+.22	+.17

TABLE IV

Reduction in VC in Litre When Corresponding Postures of Groups II and III are Compared With Group I

Posture	II	III
Standing	.18	.04
Sitting	.21	.12
Lying	.24	.08

Grossly, the mean values of all investigations of groups I, II and III are given in Table II.

Discussion

Our aim for this study was to find out the change, if any, in lung volumes and vital capacity in the last trimester and within 48 hours after delivery. Out of the 75 subjects studied antenatally, we could repeat the study only in 24 subjects

TABLE I

Results of Group 1 and 2

Surface area in sq. meter	Group	Tidal volume in		Inspiratory reserve volume in		Expiratory reserve volume in		Vital Capacity in litres					
		litre	±SE	litre	±SE	litre	±SE	Standing	±SE	Sitting	±SE	Lying	±SE
1.26 to 1.35	I	0.43	±.09	0.97	±.05	1.02	±.06	1.77	±.04	1.71	±.06	1.6	±.08
	II	0.45	±.05	0.94	±.06	0.96	±.06	1.57	±.08	1.46	±.08	1.33	±.1
								P <0.05		P <0.05		P <0.05	
1.36 to 1.45	I	0.45	±.01	1.09	±.09	1.1	±.02	1.8	±.06	1.74	±.05	1.67	±.04
	II	0.48	±.02	1.03	±.04	1.04	±.06	1.61	±.05	1.5	±.04	1.41	±.05
								P <0.05		<0.01		P <0.01	
1.46 to 1.55	I	0.47	±.02	1.15	±.09	1.2	±.14	1.93	±.1	1.81	±.1	1.76	±.1
	II	0.51	±.04	1.13	±.06	1.1	±.1	1.77	±.07	1.67	±.14	1.58	±.08

TABLE II

Gross Results of Groups 1, 2 and 3

Group	Average resp. rate per minute	Tidal volume in litre	Minute volume in litre	Inspiratory reserve volume in litre	Expiratory reserve volume in litre	Vital capacity in litre		
						Standing	Sitting	Lying
I	19.4	0.45	8.75	1.07	1.11	1.84	1.76	1.68
II	23.5	0.49	11.44	1.03	1.03	1.66	1.55	1.44
III	19.6	0.47	9.25	1.06	1.09	1.77	1.64	1.59

postnatally, mainly because (1) all have not returned to our hospital for delivery and (2) only the cases where no operative intervention was necessary were included.

Results have been classified according to the surface area in groups I and II and a proportionate relationship was observed between the surface area and the lung volumes and vital capacity (Table 1). Hutchinson in 1846 first reported that VC in normal adults increases when surface area or height increases.

Average respiratory rates (RR) per minute in our study were 19.4, 23.5 and 19.6 in groups I, II and III respectively (Table II). The increase in RR and TV, increases the minute volume (MV) in order to compensate the increased demand. Pande *et al* (1973) have shown RR declining from first to third trimester and back to the normal level in postpartum stage. Dasgupta (1973) observed an increase in MV, whereas Pande *et al* (1973) reported reduction in the third trimester and maintainance at that level postnatally, between 1 and 16 weeks. MV in group III of our study was less than that of group II (Table II).

We observed decrease (40 ml) in IRV in group II as compared to group I (Table II). Pandya *et al* (1972) reported the same. Cughell (1953) found 5 per cent decrease in IRV in pregnancy. IRV in group III of ours, is more than that of group II, but has not reached the value of group I. Any change in IRV can be due to a change in the balance between lung and chest elasticity, muscle strength, thoracic mobility, mid-position and TV. Relative increase of TV encroaching upon the IRV might have reduced it.

ERV was decreased (78 ml) in group II when compared to group I (Table II). Such observations are also reported by Cughell *et al* (1953), Pande *et al* (1973), Pandya *et al* (1972) and Rubin *et al* (1956). The decrease in ERV might be due to the increase in TV. Any change in thoracic and abdominal muscle strength, thoracic mobility and the balance of elastic forces can also bring a change in ERV.

In all the 3 groups, VC was maximum in standing and minimum in lying down position. The decrease in VC in group II was significant statistically as compared to group I (Table I). VC was slightly increased after delivery (group III, Table II). Similar findings have been reported by Alward (1930), Anthony and Hensen (1935), Boltrot and Forschbach (1910) and Rubin *et al* (1956). Several authors reported no change VC during pregnancy including Cughell *et al* (1953), Enright *et al* (1935), Rowe *et al* (1931), Thomson and Cohen (1938) and Wittich *et al* (1920). Pande *et al* (1972) and Pandya *et al* (1972) reported increase in VC.

Pair 't' was done in all the investigations in groups II and III and found to be insignificant. Similarly, our attempts to correlate the lung volumes and VC with the parity were futile.

Summary

Lung volumes and Vital capacity were studied in the last trimester and within 48 hours after delivery. These were compared to those of normal adult females. An increase in tidal volume, decrease in inspiratory reserve volume, expiratory reserve volume and vital capacity (statistically significant) were observed in pregnancy. Parity did not influence the results signficiantly.

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