TABLE IV.
Normal relative values for the different lung volumes based on 27 observations.

Total capacity	100	T
Middle capacity	62	$T \times \frac{62}{100}$
Residual air	24.7	$T \times \frac{24.7}{100}$
Vital capacity	75.3	$T \times \frac{75.3}{100}$
Reserve air	37.3	$T \times \frac{37.3}{100}$
Complementary air	38.01	$T \times \frac{38.0}{100}$

73 (2033)

Studies on lung volume. VII. Relation of size of chest to lung volume.

By CHRISTEN LUNDSGAARD and KNUD SCHIERBECK.

[*From the Medical Clinic of the University of Copenhagen, Denmark.*]

In 1918 Lundsgaard and Van Slyke[1] worked out the quantitative relationship between the different lung volumes and the size of the chest (so-called chest volume) in 18 normal individuals. The size of the chest was determined as the product ("chest volume") of three dimensions, the height, depth, and width of the thorax. The ratio between the chest volume and the lung volume in the corresponding position was found to be 55 for maximum expiration, 37 for middle capacity, and 19 for maximum inspiration. We thought it would be of value to increase the number of observations. We used the technique described by Lundsgaard and Van Slyke in measuring the chest dimensions and the total capacity. Complete mixture has always

[1] Lundsgaard, C., and Van Slyke, D. D., *J. Exp. Med.*, 1918, xxvii, 65.

been present. The residual air we determined indirectly as the difference between total capacity and vital capacity and the middle capacity was determined by rebreathing from a spirometer.[2] The material includes 27 normal subjects (18 men and 9 women). The figures for the relative lung volumes reported in a previous communication, are based on the same observations. We obtained the following average figure (Table I). It is in approximate agreement with the figures obtained by Lundsgaard and Van Slyke (Table II). The discrepancies are probably due to the fact that the middle capacity, the vital capacity, and the residual air are determined in a slightly different way. (See Lundsgaard and Van Slyke, and Lundsgaard and Schierbeck.[3] We believe that the procedure adopted in this paper is the more preferable. The mean error on each determination helps in deciding whether or not an observation in a patient may be considered pathological or not. The ratio between the "chest volume" in after maximum inspiration and maximum expiration respectively indicates the range of the thorax movement.

TABLE I.

Average values for ratios of "chest volumes" to lung volumes in 27 normal subjects. Ratio of "chest volume" after maximum expiration to "chest volume" after maximum inspiration. Mean error and mean error in percentage of average figure.

Position of chest and lungs.	Abbreviation.	Number of subjects.	Average figure.	Mean error.	Mean error in percentage of average figure
$100 \times \frac{\text{Total lung volume.}}{\text{"Chest volume" after full inspiration.}}$	$\frac{V_t}{C_t} \times 100$	27	55.7	3.1	5.6
$100 \times \frac{\text{Middle lung capacity.}}{\text{"Chest volume" in same position.}}$	$\frac{V_m}{C_m} \times 100$	25	40.3	4.4	10.9
$100 \times \frac{\text{Residual air.}}{\text{"Chest volume" after full expiration}}$	$\frac{V_r}{C_r} \times 100$	27	18.3	3.2	17.5
$100 \times \frac{\text{Vital capacity.}}{\text{"Chest volume" in resting position.}}$	$\frac{V_v}{C_m} \times 100$	27	49.1	6.7	11.6
$100 \times \frac{\text{"Chest volume" after full expiration}}{\text{"Chest volume" after full inspiration}}$	$\frac{C_r}{C_t} \times 100$	27	74.7	5.0	6.7

2 Lundsgaard, C., and Schierbeck, K., Paper No. 6 of this series.

3 Lundsgaard, C., and Schierbeck, Paper No. 6 of this series.

TABLE II.

Ratio between "chest volumes" and lung volumes. For explanation see Table I.

Author.	Number of observations.	$\frac{V_t}{C_t} \times 100$	$\frac{V_m}{C_m} \times 100$	$\frac{V_r}{C_r} \times 100$	$\frac{V_v}{C_m} \times 100$
Van Slyke and Lundsgaard	18	54.1	37.9	18.6	45.
Present paper	27	55.7	40.3	18.3	49.1

74 (2034)

Studies on lung volume. VIII. Patients with heart disease (mitral lesions).

By CHRISTEN LUNDSGAARD and KNUD SCHIERBECK.

[*From the Medical Clinic of the University of Copenhagen, Denmark.*]

The lung volumes were determined in 11 adult patients with mitral lesions. Three of the patients were in the uncompensated state of the disease. Nine were in the compensated stage. In these last patients the second pulmonary sound was markedly accentuated indicating an increased pressure in the pulmonary circulation. Our technique was as previously described.[1] Care was taken to secure full mixture in determining the total capacity. All the lung volumes are given at room temperature and observed pressure as in previous publications of the series.

Results. Discussion will appear more complete elsewhere [2, 3] and only the main results will be given here. Relative lung volumes are given in Table I in percentage of the normal relative value for total capacity, middle capacity, residual air, and vital capacity, respectively (100, 62.0, 24.7, and 75.3) established in a previous paper.[4] These values show in all instances

1 Lundsgaard, C., and Schierbeck, K., Paper No. 6 of this series.

2 Lundsgaard, C., *Journ. Amer. Med. Ass.*, 1923.

3 Lundsgaard, C., and Schierbeck, K., Paper No. 6 of this series.