Respiratory Compliance in Obese Patients

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The maintenance of adequate pulmonary ventilation is a major anesthetic problem in the obese patient.1,2 We have recently anesthetized five patients who weighed more than 300 pounds. This report describes respiratory volume-pressure relationships of these patients and compares them with measurements from a group of patients of similar height but normal weight.

METHOD

The patients studied were all female: five were obese (weight range 305–468 pounds, average 384 pounds; mean height 170 cm) and five of normal weight (average 117 pounds; mean height 169.3 cm). All studies were made with the patients in the supine position during general endotracheal anesthesia with nitrous oxide—oxygen and sufficient d-tubocurarine to abolish respiratory efforts. The obese patients were scheduled for jejunoleal bypass or gynecologic surgery, and measurements were made prior to laparotomy. Normal-weight patients were studied in the lithotomy position during minor gynecologic surgery.

To simulate obesity in normal-weight subjects, they were studied a second time after placing 50 pounds of sand bags on the lower thorax and upper abdomen. This technique (mass loading) accurately simulates the effects of obesity on pulmonary mechanics.3

Volume data were obtained by static inflation to various volumes above functional residual capacity with a giant syringe. The patients then exhaled passively into a waterless spirometer.† Exhaled volumes measured by the spirometer transducer were corrected to BTFS. Airway pressure was measured at the endotracheal tube adapter.‡ To facilitate comparison of data within and between groups, every inflation volume is presented as a percentage of the patient's calculated vital capacity. Calculated values were obtained by the method of West,§ which was chosen because it is based on height only.

The correlation coefficient for any group of pooled data was r > .75 and each graph (figs. 1 and 2) shows a line of best fit for pooled data. Statistical analysis was by t test.

RESULTS

Compliance of the respiratory system is decreased by mass loading (P < .001) and by obesity (.001 < P < .005) (fig. 1). There was no compliance difference between 50-pound mass loading and obesity (P > .5).

At any respiratory volume, compliance of obese patients was approximately half that of normal-weight patients (fig. 2). Also, the increases in compliance were almost identical in the two groups (23 ml/cm H2O for normal weight and 20 ml/cm H2O for obesity) as lung volume was increased from 10 to 40 per cent of vital capacity above functional residual capacity.

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§ Wedge, Model 270, Med-Science, St. Louis.
DISCUSSION

Respiratory compliance is decreased in obesity. The volume-pressure (fig. 1) and compliance-lung volume (fig. 2) relationships in the obese were the same as those seen in normal-weight individuals with mass loading of the lower thorax and upper abdomen. Also, changes in compliance with changes in lung volume (fig. 2) were identical in patients of normal weight and in obese patients or those in whom mass loading had been instituted. This indicates that respiratory system elasticity (ΔV/ΔP) is the same in each situation, and the difference between the two groups is a volume-independent gravitational (pressure) effect. Thus, the low respiratory compliance in obesity would seem to result from weight only.

Comparing our data in female patients with those obtained by Kallos et al.\textsuperscript{5} in men suggests that there is no sex difference in respiratory volume-pressure or compliance-lung volume relationships. It should again be emphasized that when compliance data are presented, the lung volume at which they were measured should be stated (fig. 2).

REFERENCES