THE EFFECT OF VARIOUS SURGICAL POSITIONS ON VITAL CAPACITY *

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POSTURE on the operating table has received interest from time to time, and past studies have emphasized various aspects of the subject. In 1919, Haldane, Meekins, and Priestley (1) observed that abnormal shallowness of breathing was found to cause uneven ventilation, and this in turn caused anoxemia, consequently periodic respiration and other symptoms. The recumbent position slowed and deepened respiration, and if this deepening was prevented the symptoms of anoxemia were produced. Comfort for the patient, during and after surgery (2), as well as position to make muscular relaxation possible in a lighter plane of anesthesia, was considered by Palmer in 1924. These factors were further emphasized nearly ten years later by Dutton (3), who showed crowding of the thoracic cage in kidney and lithotomy positions by use of roentgenograms. Recently (1943), Altschule (4) has shown that the Trendelenburg position, tight abdominal binders, and postoperative pain elevate the diaphragm, thereby predisposing to atelectasis. These same factors induce shallow and inefficient respiration favoring anoxemia, fatigue of the respiratory center, and accumulation of secretions.

This study was undertaken with the object of securing vital capacity measurements with patients in various positions for a short time only. Vital capacity may be defined as the sum of complemental and reserve or supplemental air. No attempt was made to measure the various portions of the total pulmonary capacity.

METHOD

Vital capacity was measured in thirteen operative positions, using ambulatory subjects. The subjects were instructed to take a maximum inhalation of air and to make a maximum exhalation into a rubber

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tube connected with a water spirometer. This amount of air was measured in cubic centimeters. When the subject understood the instructions these readings were taken in each position with a period of one minute's rest between. The subjects were kept in each position for three minutes before any readings were made. A total of 26 sub-

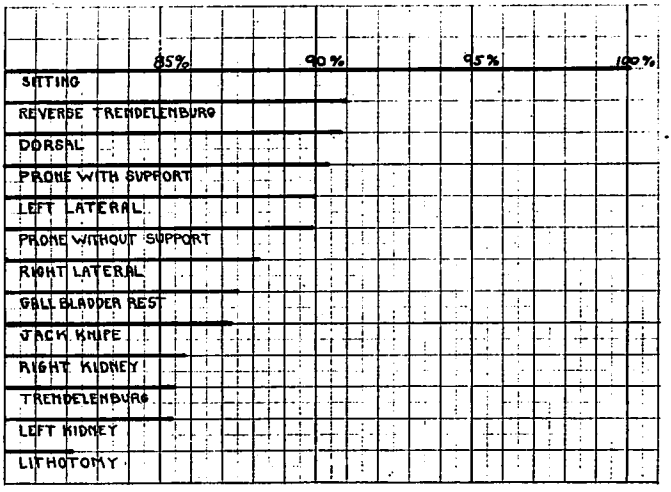

FIG. 1. Vital capacity was found to be maximum in the sitting position, and therefore those readings for this graph are called 100 per cent. The vital capacity in each of the other positions is expressed as a percentage of this maximum.

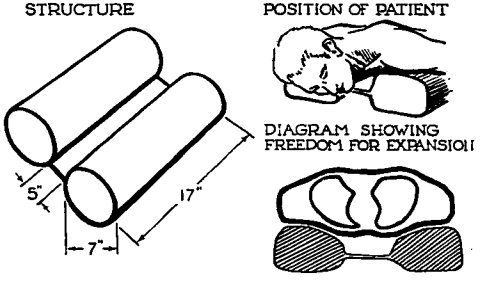

FIG. 2. Chest expansion is hampered if patients in the prone position are flat on the table. The above pictured support was devised to allow for increased expansion of the chest and therefore of the lungs in the prone position.

jects was tested, ranging in age from 22 to 78 years. The majority were young healthy adults. The following positions were used: sitting, supine, prone with shoulder support, prone without support, right and left lateral, right and left lateral, right and left kidney, gallbladder, reversed Trendelenburg 20°, Trendelenburg 20°, jack-knife, and lithotomy (fig.1).

Because chest expansion is hampered by the subject flat on the table in the prone position the support pictured in figure 2 was placed under his chest. This allows for abdominal and chest movement with less effort than when the entire weight of the patient is resting flat on the table.

RESULTS

The highest readings in all cases were obtained in the sitting position. The most marked changes occurred in Trendelenburg and lithotomy positions and those in which rests were used. The younger subjects as a rule showed less marked changes than did the elderly ones.

These findings being obtained on unnarcotized subjects are inconclusive as far as anesthetized patients are concerned; however, they do show certain definite trends. If a decrease of vital capacity is noted in a matter of three minutes on being placed in these positions, it may naturally be assumed that maintenance of these positions over extended periods must of necessity produce greater changes in the same direction. Vital capacity, of course, presupposes the patient awake and makes a maximum effort to fill and empty his lungs. When the patient is anesthetized, this voluntary effort is immediately lost; therefore, more profound changes in exchange of gases could be expected.

COMMENT AND CONCLUSION

This study has shown that the most unfavorable positions for patients on the operating table, as far as interference with vital capacity is concerned, are Trendelenburg, lithotomy and those in which rests are used. From these results we conclude that patients operated in the positions which interfere most with vital capacity when awake should remain under anesthesia in these positions the least amount of time commensurate with good surgery, thus producing a minimum of trauma to circulatory system and other mechanisms of the body which depend on intact circulation for adequate function.

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