IOSR Journal of Nursing and Health Science (IOSR-JNHS)
e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 9, Issue 3 Ser. II (May - June 2020), PP 32-38
www.iosrjournals.org

"A Study to Assess the Effects of Different Body Positions on Lung Function in Geriatrics"

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Abstract:
***Background**: The respiratory system contains the organs and structures responsible for providing oxygen to all parts of the body. As with other organs, lung function changes with the normal aging process. As a population ages, quality of life related to decreased pulmonary function in elderly people becomes a common concern. In many normal people a sizable part of the lung is ventilated at a much slower rate than the remainder. It is also established that a change in body position from sitting to recumbent will alter the size of the various subdivisions of the lung volume. Hence the present study was done to find the effects of body position on lung function in Geriatrics.*

***Materials and Methods:** A within group prospective study design was used to examine the inter-relationship between indices of lung function and different body positions in Geriatrics. Forty subjects were included in the study. All Subjects were tested for three sessions over six month interval. In each session, lung function test was performed with different body position, namely sitting, half lying and supine lying.*

***Results**: In lung function test, the outcome measure of FVC was analyzed using repeated measure of variance and the sitting position was found to be more significant than the half lying($p<0.001$; $q=7.690$) and the supine lying($p<0.001$; $q=8.892$) positions. The outcome measure of FEV_1 in sitting position was higher than that of half lying ($p<0.001$; $q=10.047$) and supine lying ($p<0.001$; $q=12.113$).*

***Conclusion:** From this study, it has been concluded that sitting position is more effective than half & supine lying in improving lung function in Geriatrics, thus proving hypothesis.*

***Key Word:** Body Positions, Lung Function, Forced Vital Capacity, Forced Expiratory Volume and Geriatrics.*

Date of Submission: 01-05-2020 Date of Acceptance: 14-05-2020

I. Introduction

Geriatrics is leading the way when it comes to thinking about health care and healthcare quality differently [1]. The proportion of the population over 65 years of age currently is more than 15% in most developed countries and is expected to reach 20% by the year 2020.[2] In India about 12 million were aged 60 years or more in the beginning of this century. The number of the aged doubled in the next sixty years to 24 million. More than half of the elderly have one or more chronic disease and disability. The ten most common diseases are: hypertensions, cataract, osteoarthritis, chronic obstructive pulmonary disease, ischemic heart disease, diabetes, benign prostatic hypertrophy, dyspepsia, constipation and depression. The five most frequent causes of death in the elderly are bronchitis and pneumonia, ischemic heart disease, stroke, cancer and tuberculosis. [3]

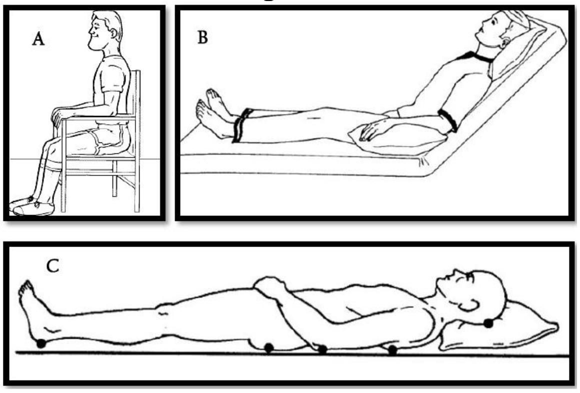
The respiratory system contains the organs and structures responsible for providing oxygen to all parts of the body. As with other organs, lung function changes with the normal aging process. As a population ages, quality of life related to decreased pulmonary function in elderly people becomes a common concern. In many normal people a sizable part of the lung is ventilated at a much slower rate than the remainder. Means have been devised for measuring the volume and ventilation rate of these "slow spaces" [4, 5]. It is also established that a change in body position from sitting to recumbent will alter the size of the various subdivisions of the lung volume [6, 7]. In the course of some observations on intrapulmonary gas mixing, it was found that changes in body position caused significant changes in size and ventilation rate of the "slow spaces."

A change in the body position may alter the respiratory pattern and overall function of respiration. In older individuals the change in the lung structure and function which will make changes in the spirometric values. They may adapt different pattern of respiration while changing body position. [9] A few investigations were found to address the effects of body position on lung function. And that to the population of students, middle age-group people and subjects with disease condition (COPD). Hence the present study was done to find the effects of body position on lung function in Geriatrics.

II. Methodology

A within group prospective study design was used to examine the inter-relationship between indices of lung function and different body positions in Geriatrics. Forty subjects were included in the study. All subjects were tested for three sessions over six month interval. In each session, lung function test was performed with different body position, namely sitting, half lying and supine lying. Study was conducted at department of Cardio-Respiratory Physiotherapy Laboratory, MTPG and RIHS, Puducherry. Subject between the age group of 60 to 75years were included. Obesity with BMI (Body Mass Index) above 30Kg/m2, pulmonary diseases (both obstructive and restrictive lung diseases), history of traumatic chest injury, deformity, heart surgery, Lung Surgery, cardiac diseases and other severe disorders such as lung cancer, Spinal cord injury and stroke were excluded from the study.

Figure 1



A. Sitting position (In a Straight-back chair with hips and Knees flexed as nearly as possible to right angle).
B. Half lying position (With the head of the bed elevated to 45degrees and Knees semi-flexed or straight, if knees flexed supporting with pillows at approximately 30degrees).
C. Supine lying (With a pillow supporting the head and the limbs relaxed and unsupported)

Flow Chart 1: Shows the Study Protocol

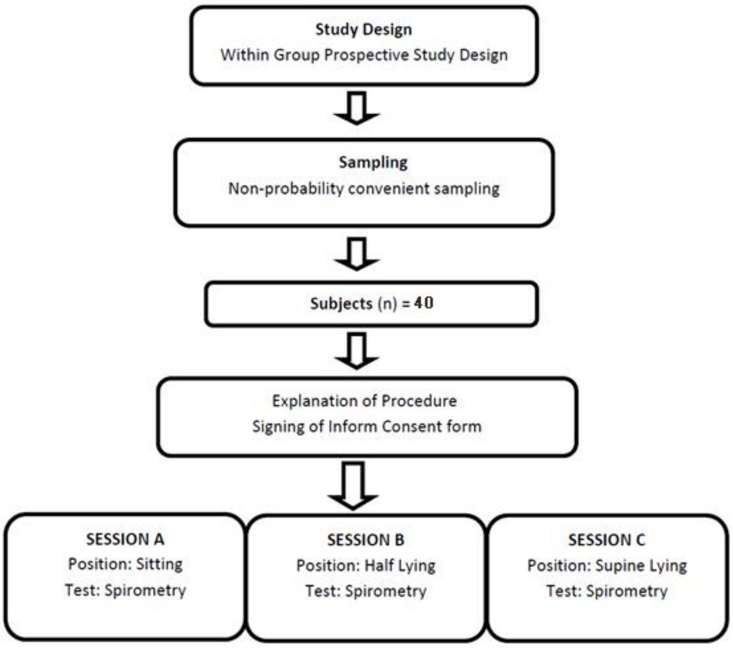


Figure 2: Pulmonary Function Test in Sitting Position

Procedure

All subjects were refrained from vigorous exercise 2hours prior to test, requested to avoid eating a heavy meal within 2hours of the test and informed to wear comfortable non-restrictive clothing. On arrival at the laboratory for the first session, the test procedures were explained to the subjects who then given written consent to participate. Diagnostic spirometer was used as a tool to assess the forced expiratory volume in one second (FEV1), forced vital capacity (FVC) and FEV1/FVC in sitting, half lying and supine lying positions.

III. Data Analysis

Obtained data was tabulated in Microsoft Excel '07 Spread sheet and then exported to compare and analysis the outcome measures of the mean score of study variables between the three groups within repeated measure ANOVA.

Table 1: Forced Vital Capacity (FVC) in Different Body Positions

Col. title	Sitting	Half Lying	Supine Lying
Mean	2.9665	2.87375	2.85925
Standard deviation (SD)	0.5815	0.5867	0.5718
Sample size (N)	40	40	40

The P value is < 0.0001, considered extremely significant. Variation among column means is significantly greater than expected by chance.

Table 2: Comparison of Forced Vital Capacity (FVC) in Different Body Positions.

Comparison	Mean Difference	q	P value
Sitting vs Half Lying	0.09275	7.690	*** P<0.001
Sitting vs Supine Lying	0.1073	8.892	*** P<0.001
Half Lying vs Supine Lying	0.01450	1.202	ns P>0.05

The P value is < 0.0001, considered extremely significant. Effective matching (or blocking) results in significant variation among means. With these data, the matching appears to be effective.

Graphical Representation of FVC

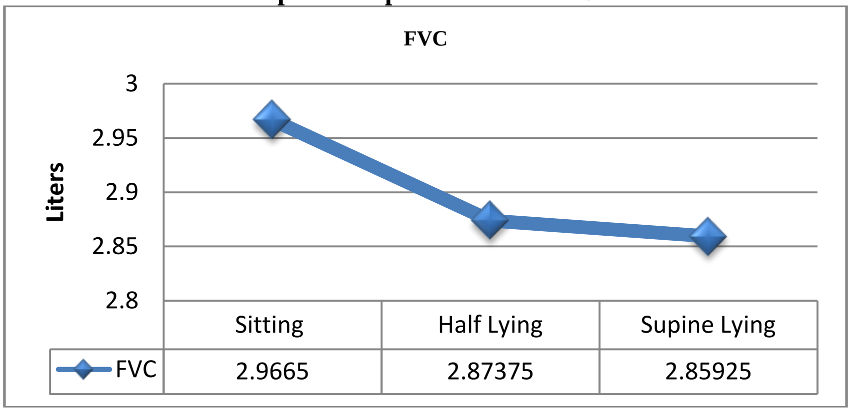


Table 3: Forced Expiratory Volume in One Second (FEV_1) at Different Body Positions

Col. title	Sitting	Half Lying	Supine Lying
Mean	2.4055	2.29	2.26625
Standard deviation (SD)	0.4327	0.4401	0.4272
Sample size (N)	40	40	40

The P value is < 0.0001, considered extremely significant. Variation among column means is significantly greater than expected by chance.

Table 4: Comparison of FEV_1 in Different Body Positions

Comparison	Mean Difference	q	P value
Sitting vs Half Lying	0.1155	10.047	*** P<0.001
Sitting vs Supine Lying	0.1393	12.113	*** P<0.001
Half Lying vs Supine Lying	0.02375	2.066	ns P>0.05

The P value is < 0.0001, considered extremely significant. Effective matching (or blocking) results in significant variation among means. With these data, the matching appears to be effective.

Graphical Representation of FEV_1

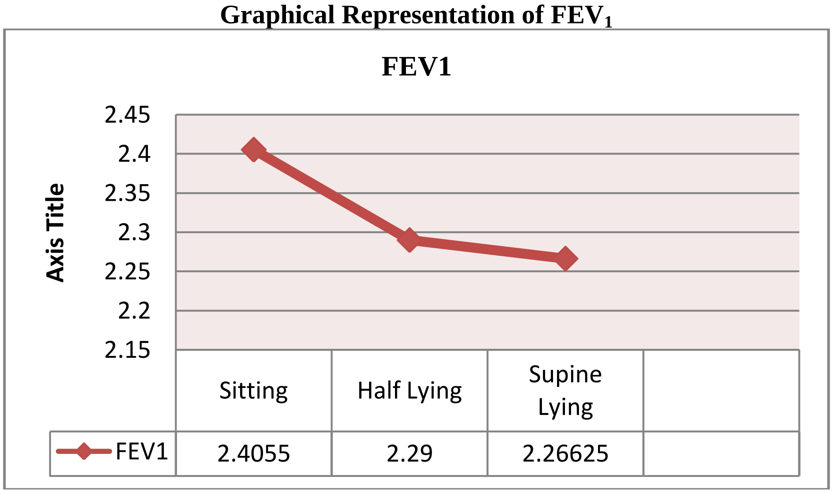


Table 5: FEV1/FVC in Different Body Positions

Col. title	Sitting	Half Lying	Supine Lying
Mean	81.4855	80.37	79.51175
Standard deviation (SD)	4.967	5.696	5.212
Sample size (N)	40	40	40

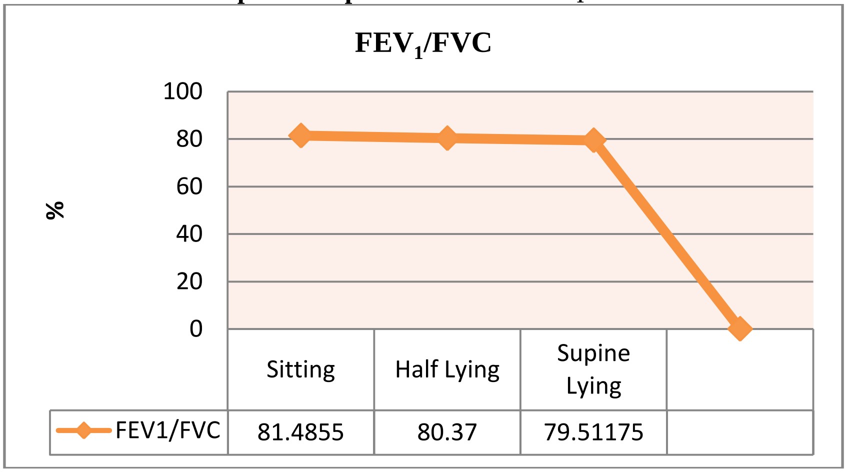
The P value is 0.0039, considered very significant. Variation among column means is significantly greater than expected by chance.

Table 6: Comparison of FEV1/FVC in Different Body Positions

Comparison	Mean Difference	q	P value
Sitting vs Half Lying	1.116	2.755	ns P>0.05
Sitting vs Supine Lying	1.974	4.874	** P<0.01
Half Lying vs Supine Lying	0.8583	2.120	ns P>0.05

The P value is < 0.0001, considered extremely significant. Effective matching (or blocking) results in significant variation among means. With these data, the matching appears to be effective.

Graphical Representation of FEV_1/ FVC



IV. Results

Forty subjects were included in the study. Of these, twenty one were male (mean age 64.4±3.2 years) and nineteen were female (mean age 62.1±2.0years). Overall, the mean age was 63.3±2.9year). The average height of males was 166.8±4.5cm and that of females was 158.3±3.7cm. The average weight of males was 66.6±6.9kg and that of females was 54.9±7.3kg. Overall, the mean height was 162.7±5.9cm and the mean weight was 61.1±9.2kg.

In lung function test, the outcome measure of FVC was analyzed using repeated measure of variance and the sitting position was found to be more significant than the half lying(p<0.001; q=7.690) and the supine lying(p<0.001; q=8.892) positions. There were no significant difference between half lying and supine lying (p>0.05; q=1.202). The outcome measure of FEV_1 in sitting position was higher than that of half lying (p<0.001; q=10.047) and supine lying (p<0.001; q=12.113) There were no variation between half lying and supine lying (p>0.05; q=2.066). The mean score of FEV_1/FVC percentage in sitting position (81.4855) was slightly higher than that of half lying (80.37) and supine lying (79.51175) positions. But the p value shows that the sitting position was not significant when compared with the half lying (p>0.05; q=2.755).

V. Discussion

This study was designed to assess the effects of different body position on lung function in Geriatrics. The result demonstrated a significant positive change in FEV1, FVC, and FEV1/FVC values in Group A (sitting position). The present study describes older population, based on a questionnaire of medical history and general activity and includes ex-smokers, four-subjects on anti-hypertensive medication. In the absence of physical examinations and diagnostic aids such as chest X-rays, particularly interested in establishing the normality of the subject group with respect to their lung function.

As expected, individual data expressed as a percent of a predicted value for each dependent variable resulted in widespread ranges. All subjects were categorized as having normal values with the exception of two-individuals whose value for FEV1/FVC percentage fell below the 95% confidence interval. Thus overall these results provided added confidence that the subjects had normal pulmonary function.

The majority of previous studies, which compare spirometric values taken in sitting and in recumbent positions, have investigated FVC in sitting and in supine lying rather than in side lying (Gaig et al, 1960). The reduction in FVC from sitting to half lying & supine lying position were analyzed in the present study is in agreement with these studies, supporting that the effect of half lying on FVC is similar to that observed in supine. The significant decrease in FEV1 in half lying and supine lying compared to sitting is in agreement with the relatively few studies which report changes in FEV1 with recumbence. (Nerregaurd, 1989; 1991).

In healthy younger adults, there is no reason to suspect a significant difference in lung function between sitting, half lying and supine lying positions. However, In an older population, the age related variation in cardiopulmonary status, for example increase in weight & volume of heart or changes in mediastinal compliance or changes in mechanism of breathing and body posture may result in differences in lung function. Thus, age-related effects on pulmonary function in sitting position may have a more significant impact than the half lying and supine lying positions.

On the basis of the above discussion, one would like to anticipate that in comparison to sitting position, both half lying and supine lying would reflect effects of airway close and increased pulmonary time constants with an increased ventilatory inhomogeneity. The answer may be related to yet another factor that may affect ventilatory inhomogeneity to an increasing degree with advancing age.

VI. Conclusion

From this study it has been concluded that sitting position is more effective than half & supine lying in improving lung function in Geriatrics, thus proving hypothesis. Hence sitting position is a safe, cost effective position promoting effective lung function. This can be beneficial when applied in Geriatrics.

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